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Received notifications

Sent	Article	Subject
2022-12-21	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Article PJOES-00324-2022-04 has been assigned to issue
2022-11-03	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	A DOI number has been assigned (PJOES-00324-2022-04)
2022-10-30	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Verification requested (PJOES-00324-2022-04)
2022-09-10	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Article PJOES-00324-2022-04 has been assigned to issue
2022-09-10	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Invoice is available for download (PJOES-00324-2022-04)
2022-09-10	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Publishing fee has been received
2022-09-02	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Publishing fee has been set (PJOES-00324-2022-04)
2022-08-29	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00324-2022-04

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	Case of Vegetable Production Center in Banjarbaru Region, Indonesia	
2022-08-29	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00324-2022-04
2022-08-17	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Manuscript has been sent to Reviewers (PJOES-00324-2022-04)
2022-08-02	**PJOES-00324-2022-04** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New revision received by Editorial Office (PJOES-00324-2022-04)

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Sudarningsih Sudarningsih AUTHOR

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Received notifications

Sent	Article	Subject
2022-07-25	**PJOES-00324-2022-03** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00324-2022-03
2022-06-25	**PJOES-00324-2022-03** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Manuscript has been sent to Reviewers (PJOES-00324-2022-03)
2022-06-24	**PJOES-00324-2022-03** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New revision received by Editorial Office (PJOES-00324-2022-03)
2022-06-20	**PJOES-00324-2022-02** Assessment of Soil Contamination by Heavy Metals: A	Decision on manuscript PJOES-00324-2022-02

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	Case of Vegetable Production Center in Banjarbaru Region, Indonesia	
2022-06-20	**PJOES-00324-2022-02** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00324-2022-02
2022-06-07	**PJOES-00324-2022-02** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New revision received by Editorial Office (PJOES-00324-2022-02)
2022-05-23	**PJOES-00324-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00324-2022-01
2022-03-08	**PJOES-00324-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Manuscript has been sent to Reviewers (PJOES-00324-2022-01)
2022-03-05	**PJOES-00324-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New manuscript received by Editorial Office (PJOES-00324-2022-01)

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	Case of Vegetable Production Center in Banjarbaru Region, Indonesia	
2022-03-05	**PJOES-00324-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New manuscript received by Editorial Office (PJOES-00324-2022-01)
2022-02-28	**PJOES-00270-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	Decision on manuscript PJOES-00270-2022-01
2022-02-24	**PJOES-00270-2022-01** Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia	New manuscript received by Editorial Office (PJOES-00270-2022-01)

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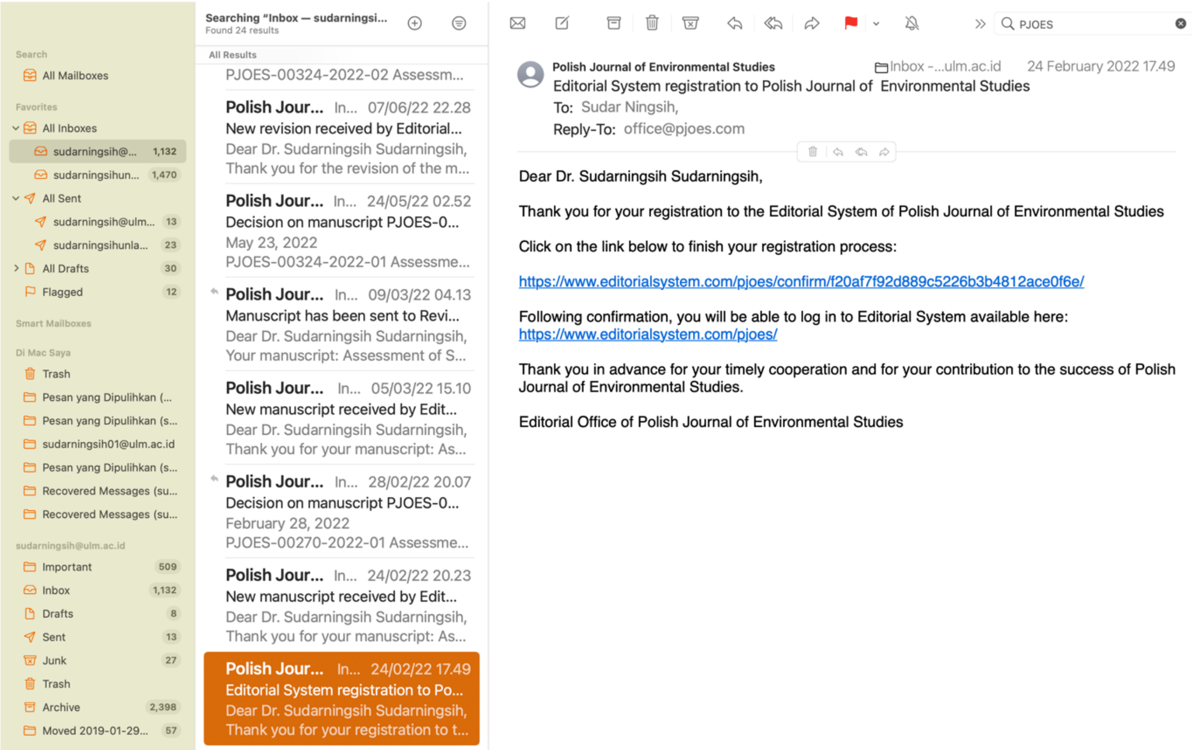


Polish Journal of Environmental Studies — Inbox - ...ulm.ac.id — 24 February 2022 17.49

Editorial System registration to Polish Journal of Environmental Studies

To: Sudar Ningsih,

Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Thank you for your registration to the Editorial System of Polish Journal of Environmental Studies

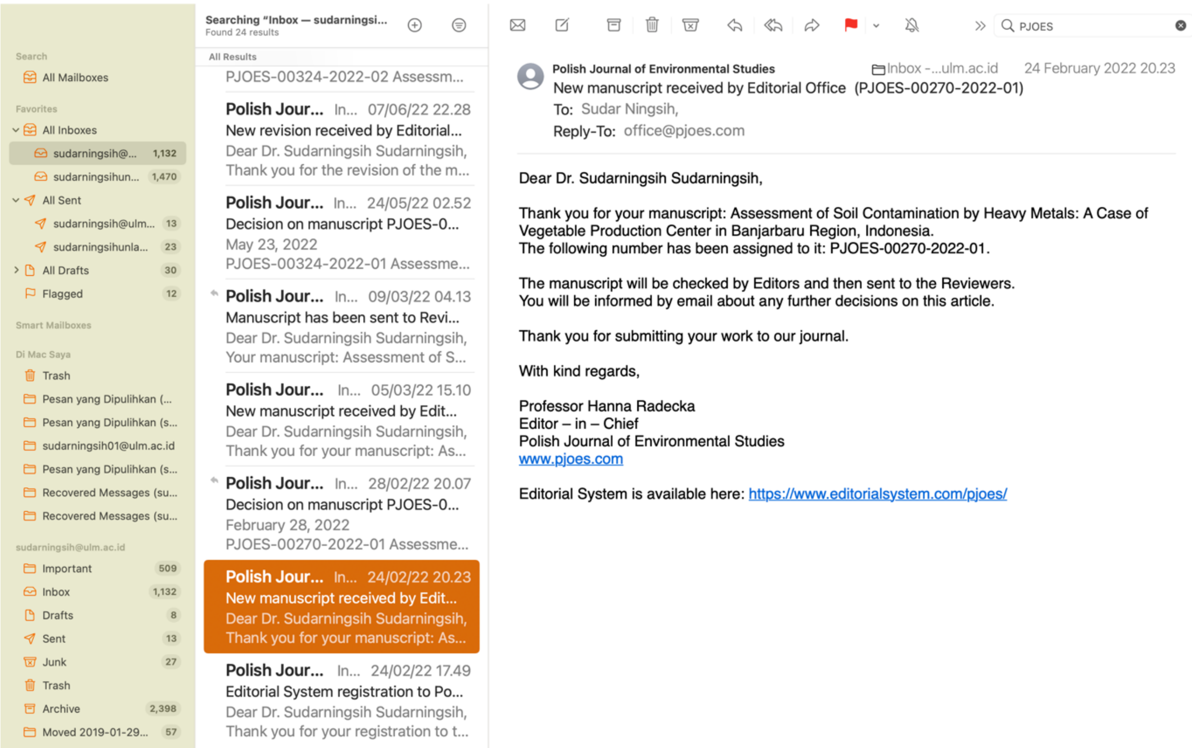
Click on the link below to finish your registration process:

https://www.editorialsystem.com/pjoes/confirm/f20af7f92d889c5226b3b4812ace0f6e/

Following confirmation, you will be able to log in to Editorial System available here:
https://www.editorialsystem.com/pjoes/

Thank you in advance for your timely cooperation and for your contribution to the success of Polish Journal of Environmental Studies.

Editorial Office of Polish Journal of Environmental Studies



Polish Journal of Environmental Studies — Inbox - ...ulm.ac.id — 24 February 2022 20.23

New manuscript received by Editorial Office (PJOES-00270-2022-01)

To: Sudar Ningsih,

Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Thank you for your manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia.
The following number has been assigned to it: PJOES-00270-2022-01.

The manuscript will be checked by Editors and then sent to the Reviewers.
You will be informed by email about any further decisions on this article.

Thank you for submitting your work to our journal.

With kind regards,

Professor Hanna Radecka
Editor – in – Chief
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Editorial System is available here: https://www.editorialsystem.com/pjoes/

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Decision on manuscript PJOES-0...
May 23, 2022
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Polish Jour... In... 09/03/22 04.13
Manuscript has been sent to Revi...
Dear Dr. Sudarningsih Sudarningsih,
Your manuscript: Assessment of S...

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Dear Dr. Sudarningsih Sudarningsih,
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February 28, 2022
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Decision on manuscript PJOES-00270-2022-01
To: Sudar Ningsih

February 28, 2022
PJOES-00270-2022-01
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I would like to thank you for sending the manuscript entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia but, references in above manuscript are insufficient. I would like to ask you for extending the scientific discussion with up-to-data references (approximately 70% of the references should be published not later than 9 years ago) and submit manuscript again.

Thank you very much for selecting "Polish Journal of Environmental Studies".

Dorota Radecka PhD
Executive editor
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Sudar Ningsih — 1 March 2022 21.18
Re: Decision on manuscript PJOES-00270-2022-01
To: dorota.h.radecka@gmail.com

Dear Executive Editor,

Thank you for the information. We will resubmit the manuscript as soon as possible.

Best Regards,
Sudarningsih

Found in Sent - sudarningsihunlam@gmail.com Mailbox

Sudarningsih Sudarningsih — 1 March 2022 21.18
Re: Decision on manuscript PJOES-00270-2022-01
To: dorota.h.radecka@gmail.com

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Sudarningsih

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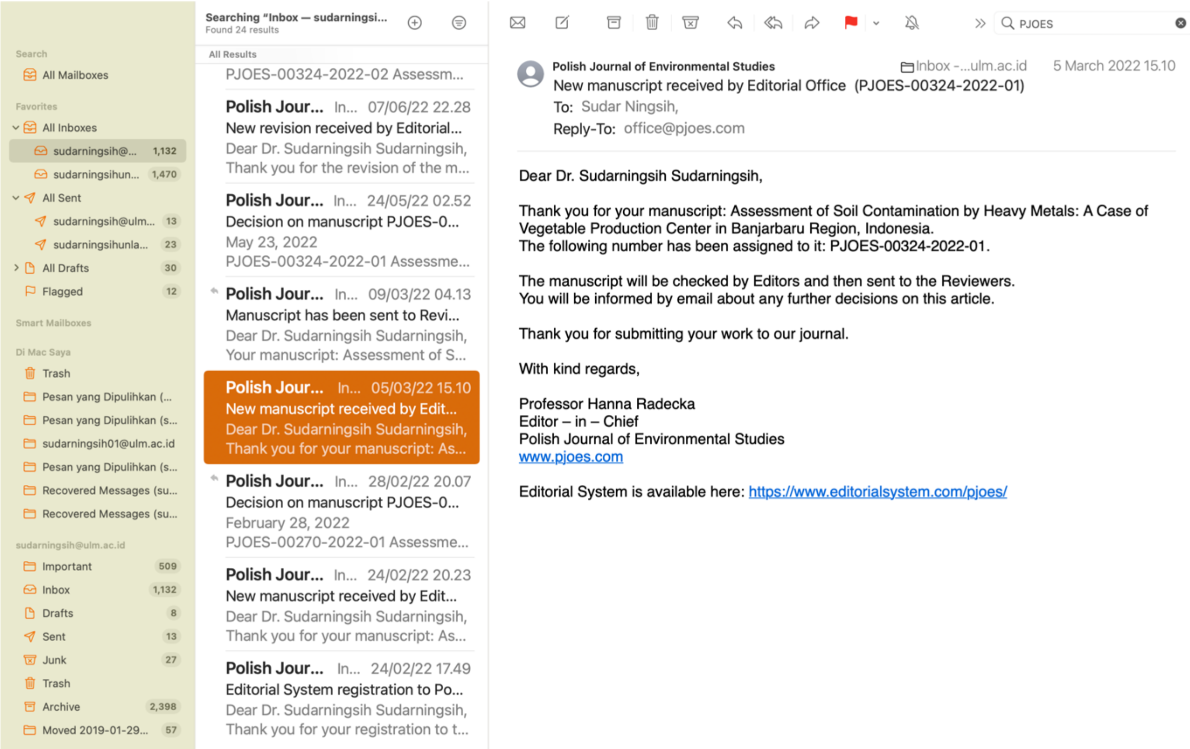

Polish Journal of Environmental Studies — Inbox -...ulm.ac.id — 5 March 2022 15.10
New manuscript received by Editorial Office (PJOES-00324-2022-01)
To: Sudar Ningsih,
Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Thank you for your manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia.
The following number has been assigned to it: PJOES-00324-2022-01.

The manuscript will be checked by Editors and then sent to the Reviewers.
You will be informed by email about any further decisions on this article.

Thank you for submitting your work to our journal.

With kind regards,

Professor Hanna Radecka
Editor – in – Chief
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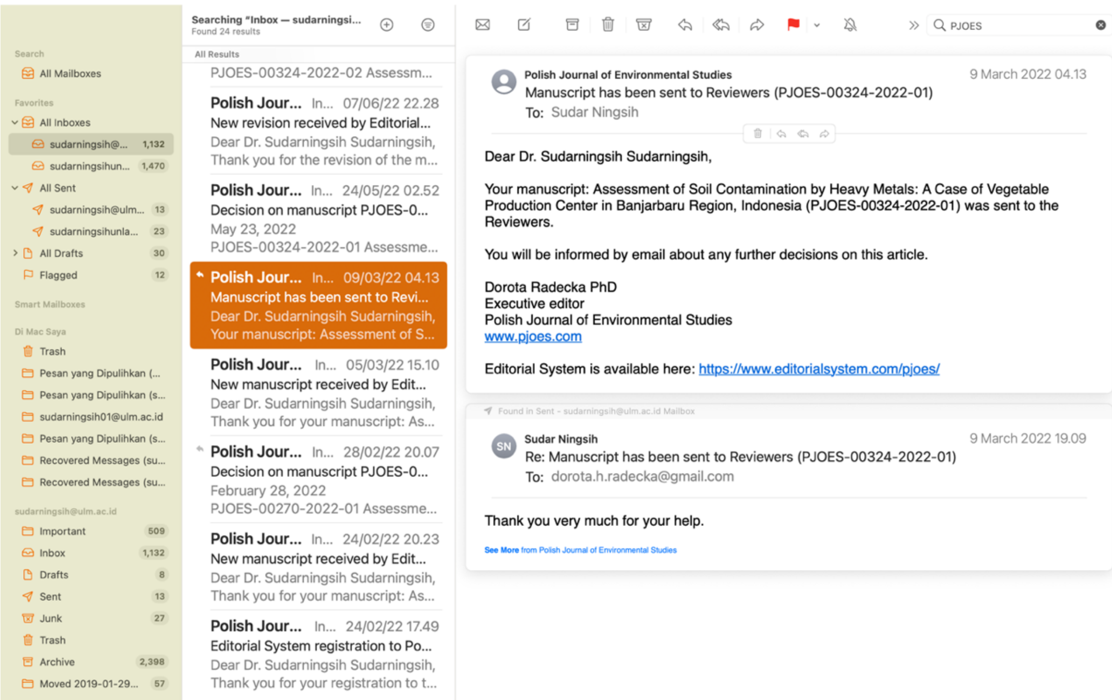

Polish Journal of Environmental Studies — 9 March 2022 04.13
Manuscript has been sent to Reviewers (PJOES-00324-2022-01)
To: Sudar Ningsih

Dear Dr. Sudarningsih Sudarningsih,

Your manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-01) was sent to the Reviewers.

You will be informed by email about any further decisions on this article.

Dorota Radecka PhD
Executive editor
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Thank you very much for your help.

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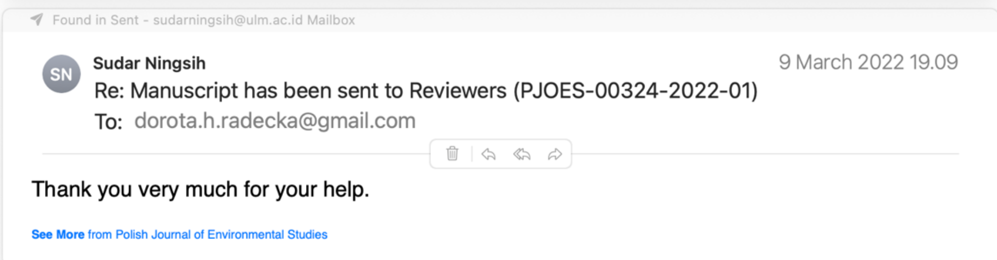

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Decision on manuscript PJOES-00324-2022-01

To: Sudar Ningsih,

Reply-To: dorota.h.radecka@gmail.com

May 23, 2022

PJOES-00324-2022-01

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript, entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia, might be accepted for publication in our journal, pending changes suggested by reviewers (see below).

Please revise your manuscript strictly according to the attached Reviewers' comments as well as Editor's remarks. Your manuscript won't be taken into consideration without the revisions made according to the recommendations.

Please, check all Editor's remarks when revising your manuscript:

- R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way
- In references all authors name must be included
- E-mail address of Corresponding Author must be provided
- Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References

Please, provide the following items:

1) copy of the fully revised manuscript that has all the changes highlighted in red colour, along with high–quality figures. Each figure prepared in colour will be charged 60 EURO

2) answers to all the Reviewer comments

Authors of our journal are requested to prepare a revised version of their manuscript as soon as possible. This may ensure fast publication if an article is finally accepted.

Thank you for submitting your work to our Journal and fruitful co-operation.

possible. This may ensure fast publication if an article is finally accepted.

Thank you for submitting your work to our Journal and fruitful co-operation.

With kind regards,

Dorota Radecka PhD

Executive editor

Polish Journal of Environmental Studies

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Please note that this email may not include all details of your article's evaluation. The full decision is available here:

https://www.editorialsystem.com/pjoes/article/294401/view/#showDecisionLetter284175

Review 1:

Authors used only 12 samples which celarly is not staticsally significant. Some justification should be given on this,

Review 2:

The manuscript should be corrected by removing unnecessary repetitions of data (the same data in Tables and in Figures) and detailed description of sites and sampling points should be added.

Summary, line 26 - why Zn is two times

Map with locations of sampling points needed

In how many repetitions analyses were conducted?

Line 107- Why division into site A and B was performed – what was the difference between thes two sites? Again map with marked Site A and B needed. Pleaese explain shortly this Rahman's method

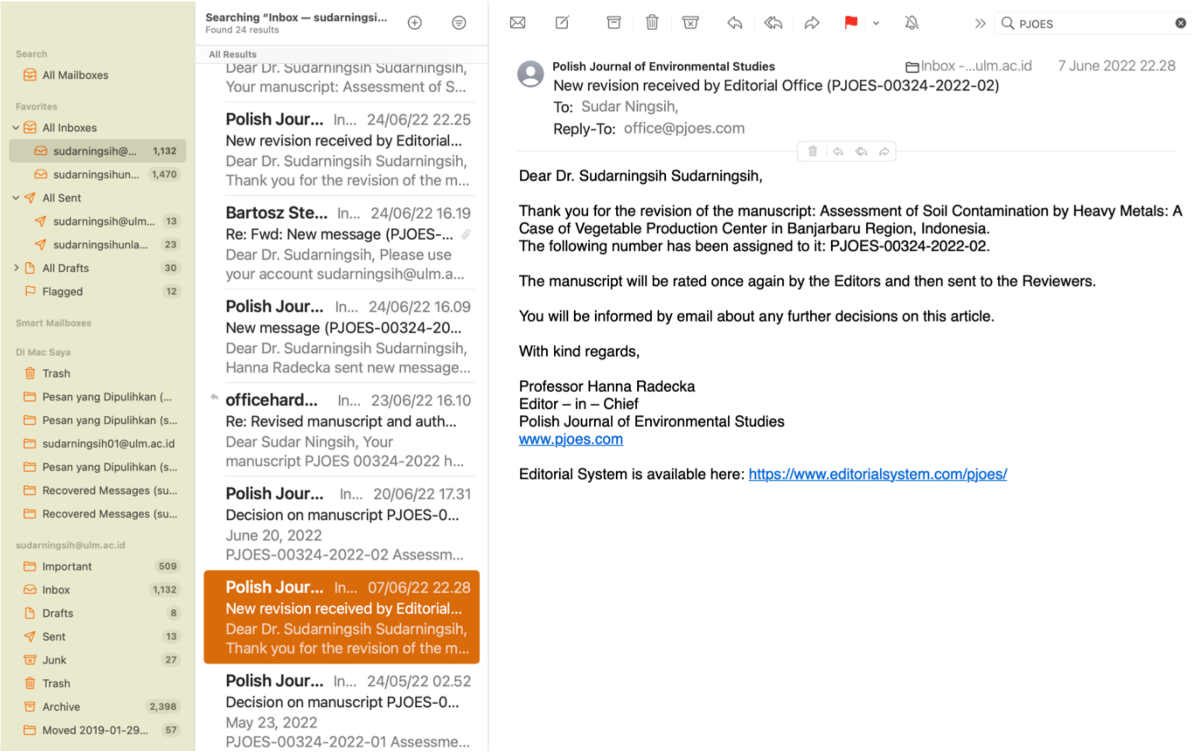
Table 1. – the same number of decimals should be maintained.

Figures 1 – 3 – These are the same data as in Table 1, remove these Figures – they are incorrect, as far as I understand there isn't any conection between f.ex. point „0" in Site A and B, so it is inappropriate to show them as one bar.

What is the differnce between Table 2 and Figure 4? They both show Igeo but the results are different.

And again this is unecessary repetitions.

I suggest to expand description of both sites and sampling points and try to explain where such big differences in specific locations come from (f.ex. in site A1). Detailed description of the way of taking samples is needed.



Polish Journal of Environmental Studies — Inbox - ...ulm.ac.id — 7 June 2022 22.28

New revision received by Editorial Office (PJOES-00324-2022-02)

To: Sudar Ningsih,

Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Thank you for the revision of the manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia.
The following number has been assigned to it: PJOES-00324-2022-02.

The manuscript will be rated once again by the Editors and then sent to the Reviewers.

You will be informed by email about any further decisions on this article.

With kind regards,

Professor Hanna Radecka
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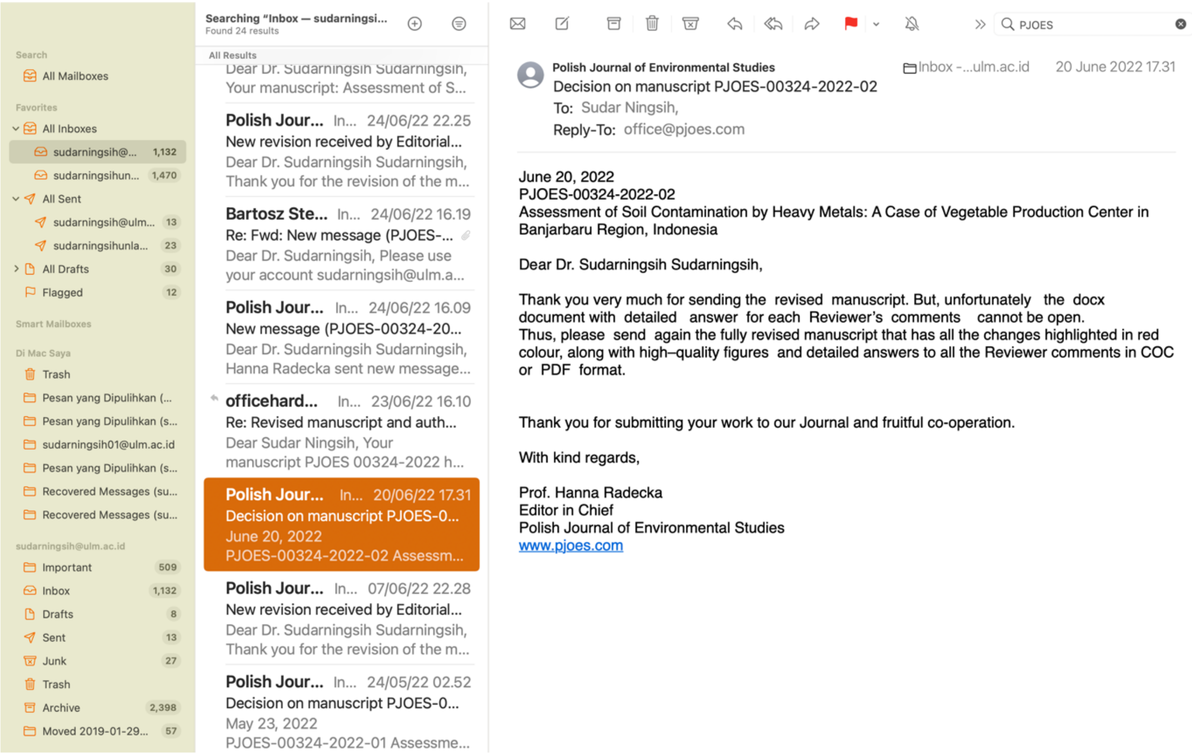

Polish Journal of Environmental Studies — Inbox - ...ulm.ac.id — 20 June 2022 17.31

Decision on manuscript PJOES-00324-2022-02

To: Sudar Ningsih,

Reply-To: office@pjoes.com

June 20, 2022
PJOES-00324-2022-02
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

Thank you very much for sending the revised manuscript. But, unfortunately the docx document with detailed answer for each Reviewer's comments cannot be open.
Thus, please send again the fully revised manuscript that has all the changes highlighted in red colour, along with high–quality figures and detailed answers to all the Reviewer comments in COC or PDF format.

Thank you for submitting your work to our Journal and fruitful co-operation.

With kind regards,

Prof. Hanna Radecka
Editor in Chief
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officehard... In... 23/06/22 16.10
Re: Revised manuscript and auth...
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June 20, 2022
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May 23, 2022
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officehard pjoes.home.pl — 23 June 2022 16.10
Re: Revised manuscript and author's respon form
To: Sudar Ningsih

Dear Sudar Ningsih,

Your manuscript PJOES 00324-2022 has been sent to revise
Revision deadline: 2022-07-21

So, please try to submit your revised manuscript and detailed answers to each reviewer comments.
I will ask our administration team to help you,

With all the best,
Hanna Radecka

> 23.06.2022 04:36 Sudar Ningsih <sudarningsih@ulm.ac.id> napisał(a):
>
> Dear Prof.Hanna Radecka
> I can't find a botton in PJOES on-line system that I can click to submit my revised manuscript
>
> With all the best,
> Hanna Radecka
>
> > 21.06.2022 07:40 Sudarningsih Sudarningsih <sudarningsihunlam@gmail.com <mailto:sudarningsihunlam@gmail.com>> napisał(a):
> >
> > Dear Prof.Hanna Radecka
> > Enclosed please find the revised manuscript and auhor's respon form in PDF format.
> >
> > Yours sincerely,
> > Sudarningsih
>
> Editor in-chief prof. Hanna Radecka
> Polish Journal of Environmental Studies
> www.pjoes.com <http://www.pjoes.com/>

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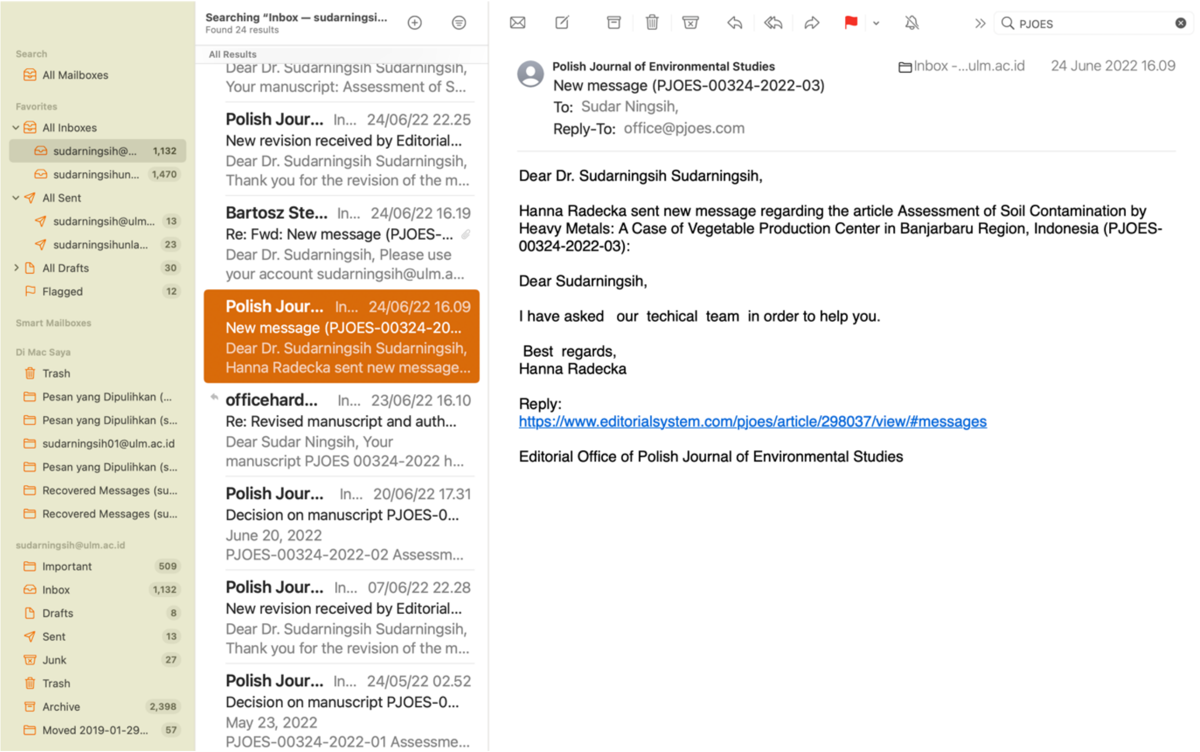
Sudar Ningsih — 23 June 2022 16.25
Re: Revised manuscript and author's respon form
To: officehard pjoes.home.pl

Thank you, I will do that.

Sincerely yours
Sudarningsih



Polish Journal of Environmental Studies   Inbox -...ulm.ac.id   24 June 2022 16.09
New message (PJOES-00324-2022-03)
To: Sudar Ningsih,
Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Hanna Radecka sent new message regarding the article Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-03):

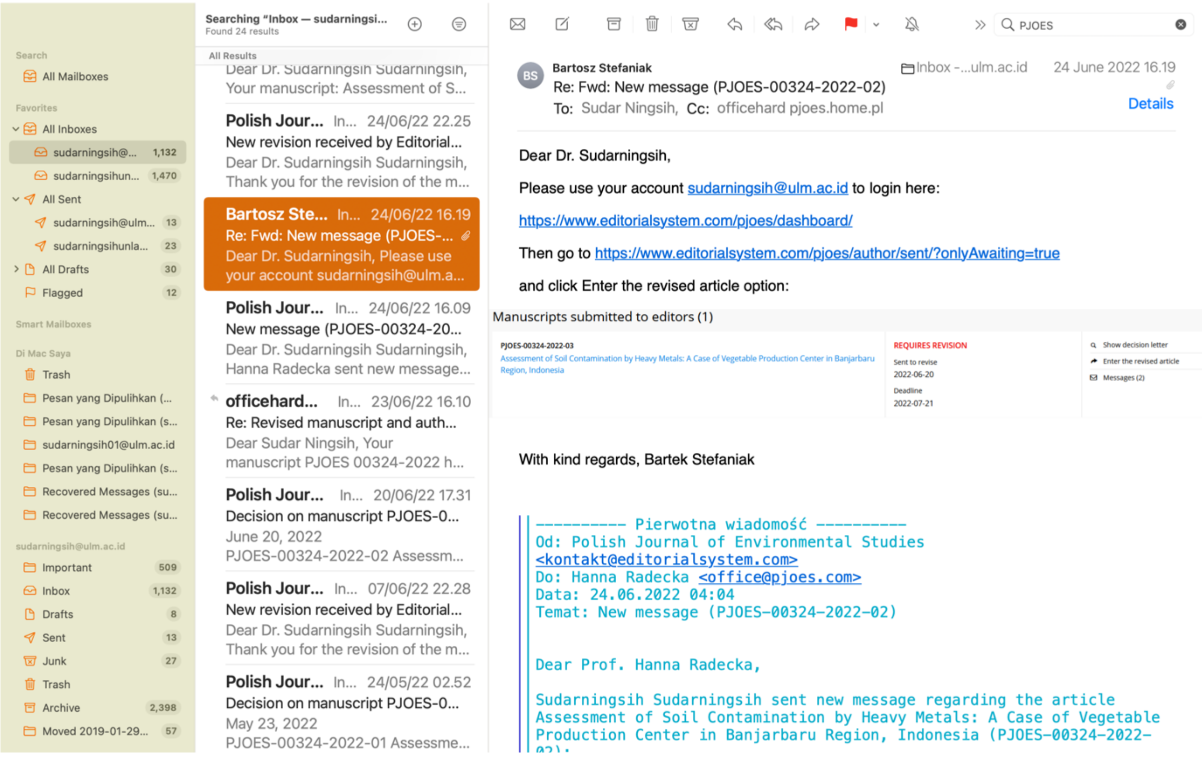
Dear Sudarningsih,

I have asked our techical team in order to help you.

Best regards,
Hanna Radecka

Reply:
https://www.editorialsystem.com/pjoes/article/298037/view/#messages

Editorial Office of Polish Journal of Environmental Studies



Bartosz Stefaniak   Inbox -...ulm.ac.id   24 June 2022 16.19
Re: Fwd: New message (PJOES-00324-2022-02)
To: Sudar Ningsih, Cc: officehard pjoes.home.pl
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Dear Dr. Sudarningsih,

Please use your account sudarningsih@ulm.ac.id to login here:

https://www.editorialsystem.com/pjoes/dashboard/

Then go to https://www.editorialsystem.com/pjoes/author/sent/?onlyAwaiting=true

and click Enter the revised article option:

Manuscripts submitted to editors (1)

PJOES-00324-2022-03
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia
REQUIRES REVISION
Sent to revise 2022-06-20
Deadline 2022-07-21
Show decision letter
Enter the revised article
Messages (2)

With kind regards, Bartek Stefaniak

---------- Pierwotna wiadomość ----------
Od: Polish Journal of Environmental Studies <kontakt@editorialsystem.com>
Do: Hanna Radecka <office@pjoes.com>
Data: 24.06.2022 04:04
Temat: New message (PJOES-00324-2022-02)

Dear Prof. Hanna Radecka,

Sudarningsih Sudarningsih sent new message regarding the article Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-02):

---------- Pierwotna wiadomość ----------
Od: Polish Journal of Environmental Studies <kontakt@editorialsystem.com>
Do: Hanna Radecka <office@pjoes.com>
Data: 24.06.2022 04:04
Temat: New message (PJOES-00324-2022-02)

Dear Prof. Hanna Radecka,

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Dear editor, I can’t find a botton in PJOES on-line system that I can click to submit my revised manuscript and auhor's respon form.

Sincerely,
Sudarningsih

Reply: https://www.editorialsystem.com/editor/pjoes/article/294401/view/#messages

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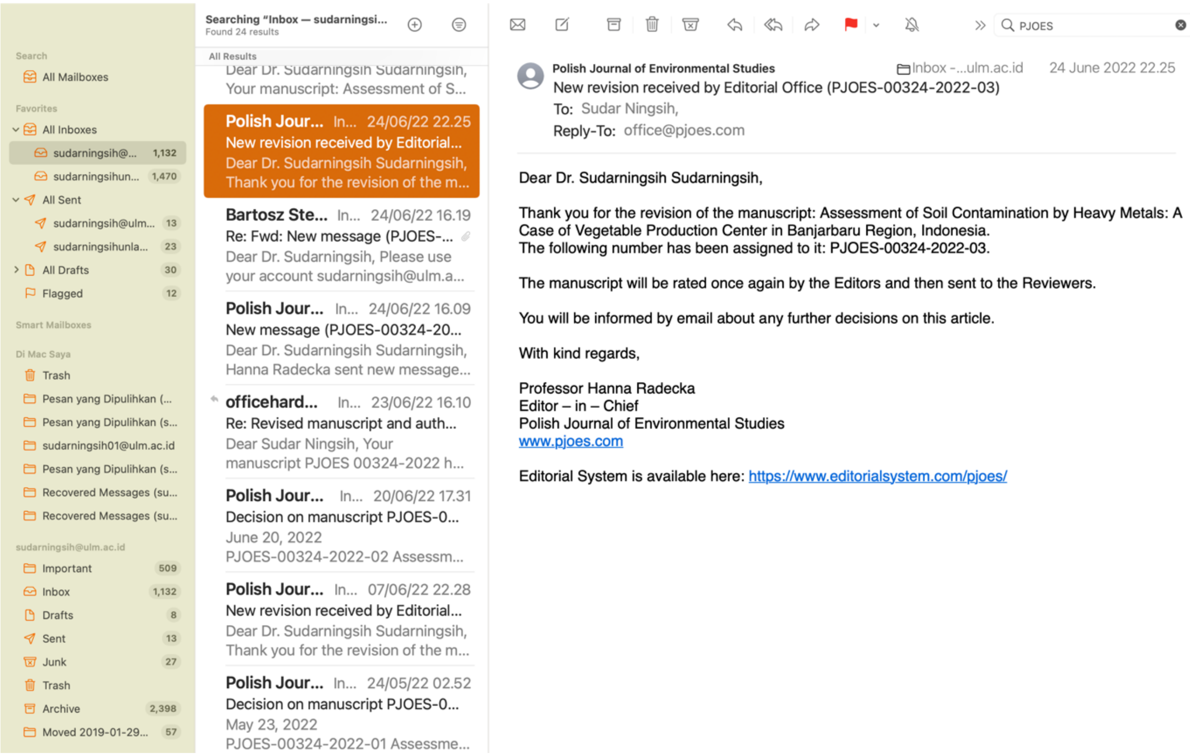
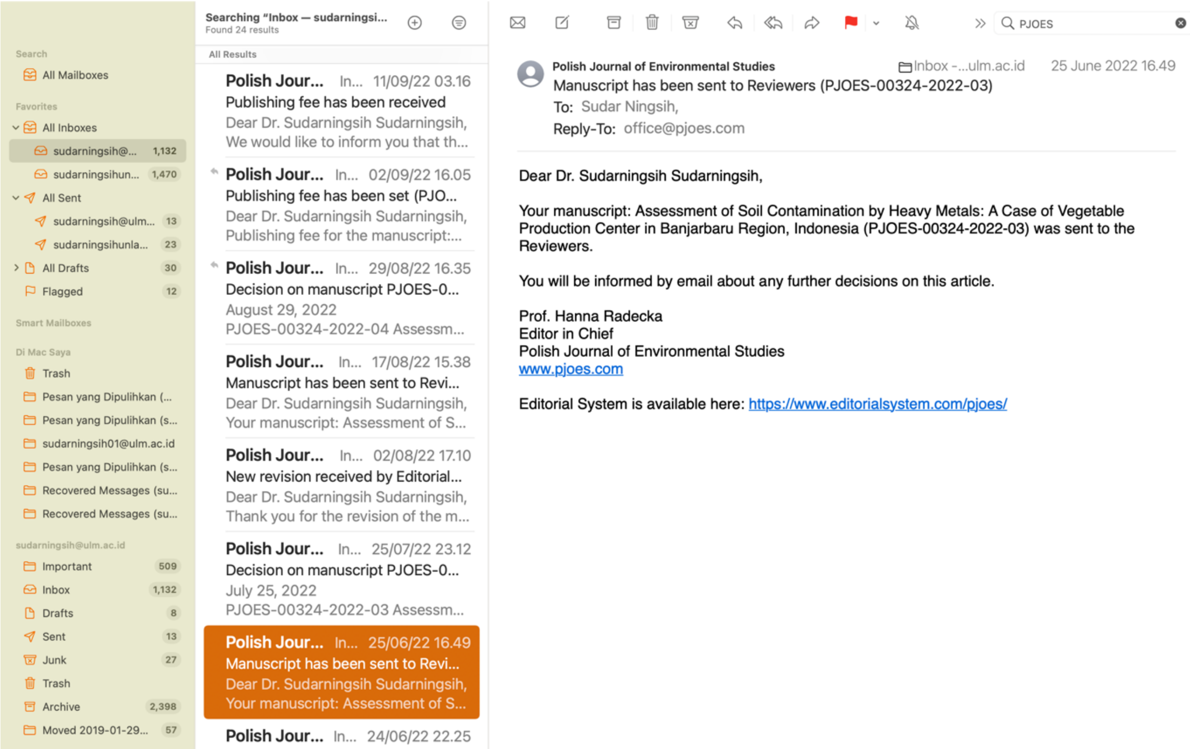




Polish Journal of Environmental Studies — Inbox -...ulm.ac.id — 25 June 2022 16.49

Manuscript has been sent to Reviewers (PJOES-00324-2022-03)

To: Sudar Ningsih,

Reply-To: office@pjoes.com

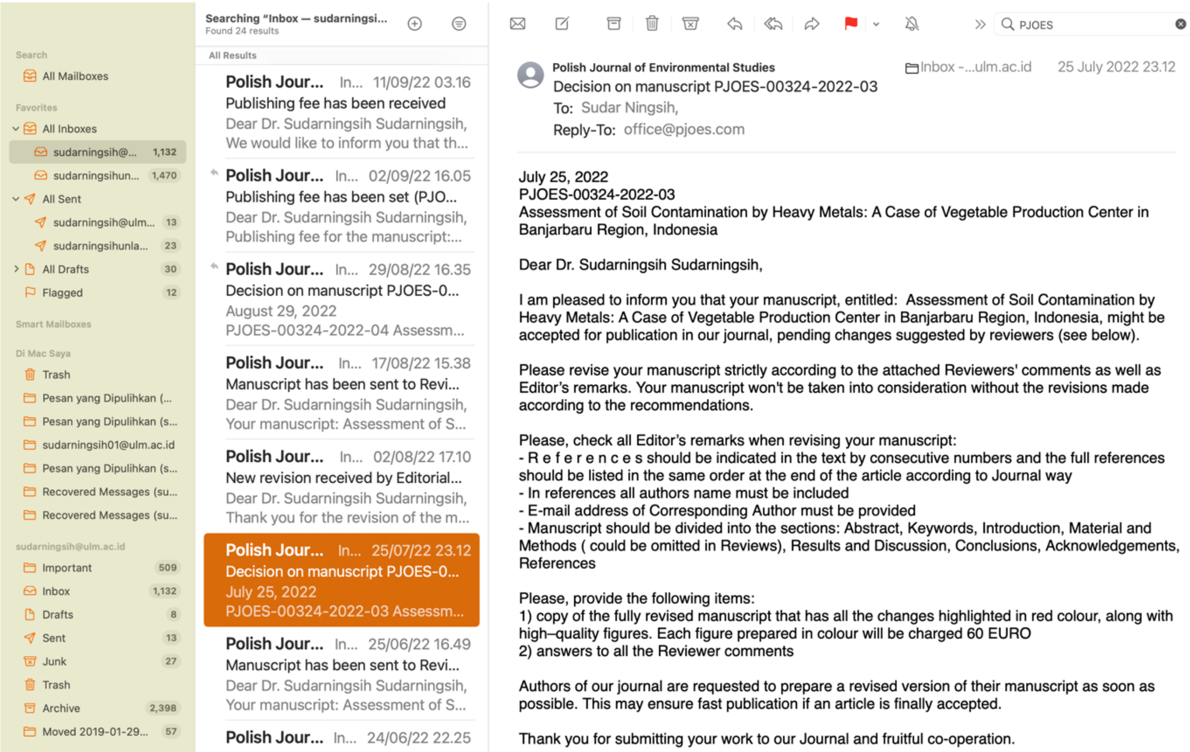
Dear Dr. Sudarningsih Sudarningsih,

Your manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-03) was sent to the Reviewers.

You will be informed by email about any further decisions on this article.

Prof. Hanna Radecka
Editor in Chief
Polish Journal of Environmental Studies
www.pjoes.com

Editorial System is available here: https://www.editorialsystem.com/pjoes/



Polish Journal of Environmental Studies — Inbox -...ulm.ac.id — 25 July 2022 23.12

Decision on manuscript PJOES-00324-2022-03

To: Sudar Ningsih,

Reply-To: office@pjoes.com

July 25, 2022
PJOES-00324-2022-03
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript, entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia, might be accepted for publication in our journal, pending changes suggested by reviewers (see below).

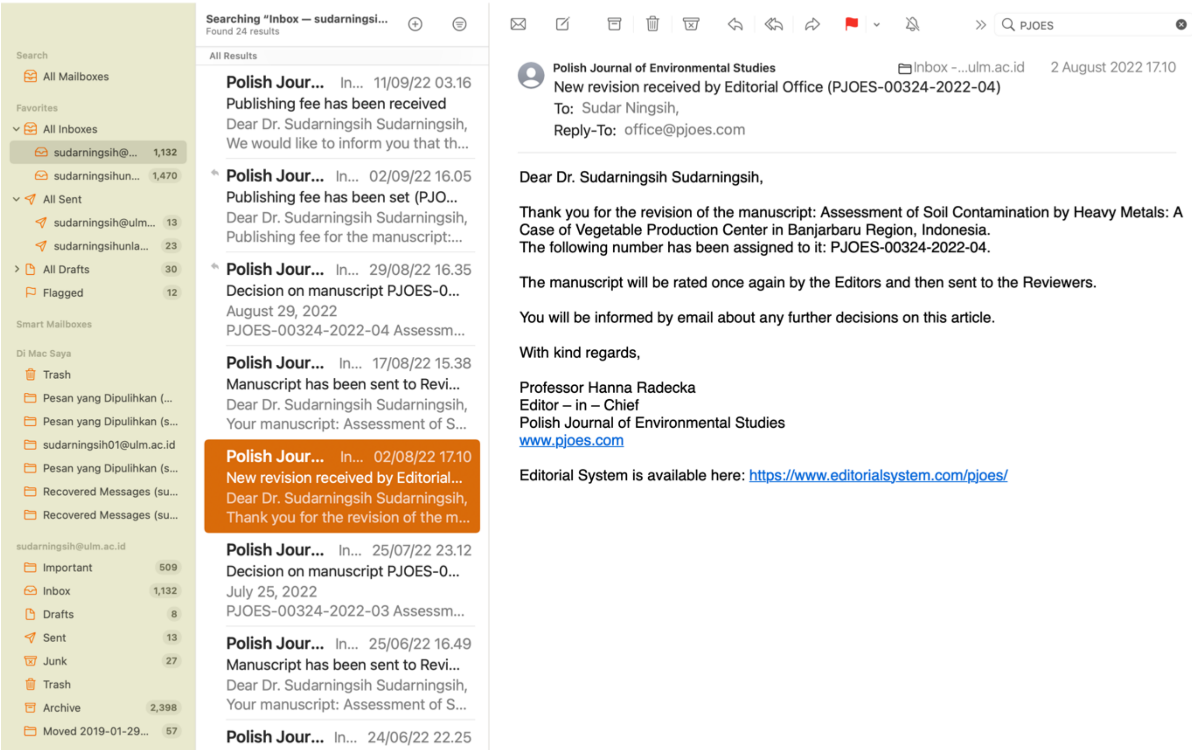
Please revise your manuscript strictly according to the attached Reviewers' comments as well as Editor's remarks. Your manuscript won't be taken into consideration without the revisions made according to the recommendations.

Please, check all Editor's remarks when revising your manuscript:
- R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way
- In references all authors name must be included
- E-mail address of Corresponding Author must be provided
- Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References

Please, provide the following items:
1) copy of the fully revised manuscript that has all the changes highlighted in red colour, along with high–quality figures. Each figure prepared in colour will be charged 60 EURO
2) answers to all the Reviewer comments

Authors of our journal are requested to prepare a revised version of their manuscript as soon as possible. This may ensure fast publication if an article is finally accepted.

Thank you for submitting your work to our Journal and fruitful co-operation.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PJOES
Polish Journal of Environmental Studies
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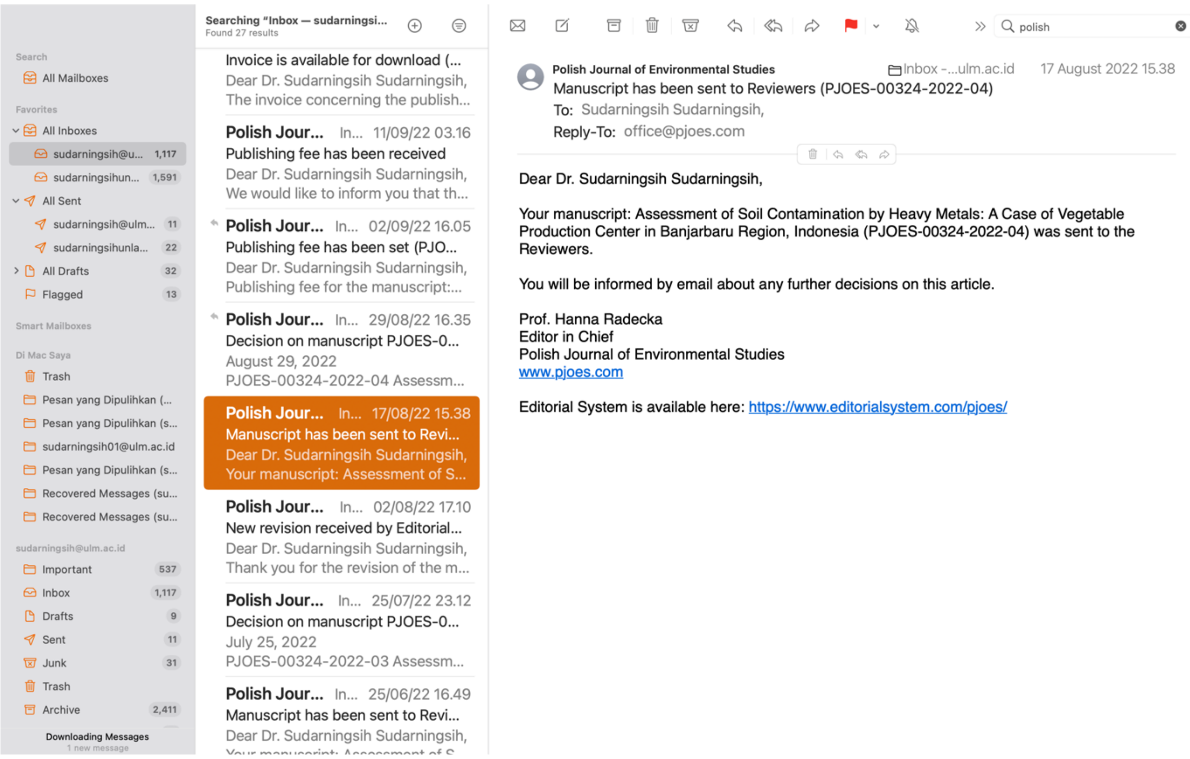
2 August 2022 17.10
New revision received by Editorial Office (PJOES-00324-2022-04)
To: Sudar Ningsih,
Reply-To: office@pjoes.com
Dear Dr. Sudarningsih Sudarningsih,
Thank you for the revision of the manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia.
The following number has been assigned to it: PJOES-00324-2022-04.
The manuscript will be rated once again by the Editors and then sent to the Reviewers.
You will be informed by email about any further decisions on this article.
With kind regards,
Professor Hanna Radecka
Editor – in – Chief
Polish Journal of Environmental Studies
www.pjoes.com
Editorial System is available here: https://www.editorialsystem.com/pjoes/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Polish Journal of Environmental Studies
Inbox -...ulm.ac.id
17 August 2022 15.38
Manuscript has been sent to Reviewers (PJOES-00324-2022-04)
To: Sudarningsih Sudarningsih,
Reply-To: office@pjoes.com
Dear Dr. Sudarningsih Sudarningsih,
Your manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) was sent to the Reviewers.
You will be informed by email about any further decisions on this article.
Prof. Hanna Radecka
Editor in Chief
Polish Journal of Environmental Studies
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Editorial System is available here: https://www.editorialsystem.com/pjoes/

Polish Journal of Environmental Studies — 29 August 2022 16.35
Decision on manuscript PJOES-00324-2022-04
To: Sudar Ningsih

August 29, 2022
PJOES-00324-2022-04
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript, entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia, has been finally accepted for publication in our journal.

Thank you for submitting your work to our Journal and fruitful co-operation.

Prof. Hanna Radecka
Editor in Chief
Polish Journal of Environmental Studies
www.pjoes.com

Found in Sent - sudarningsihunlam@gmail.com Mailbox

Sudar Ningsih — 29 August 2022 17.22
Re: Decision on manuscript PJOES-00324-2022-04
To: office@pjoes.com

Dear Editor in Chief,

We would like to thank you for considering our paper for publication and thanks to the reviewers for their valuable comments on our paper.

Best Regard
Sudarningsih Sudarningsih

See More from Polish Journal of Environmental Studies

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Sudarningsih Sudarningsih — 29 August 2022 17.22
Re: Decision on manuscript PJOES-00324-2022-04
To: office@pjoes.com

Dear Editor in Chief,

We would like to thank you for considering our paper for publication and thanks to the reviewers for their valuable comments on our paper.

Best Regard
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Manuscript has been sent to Revi...
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Your manuscript: Assessment of S...

Polish Jour... In... 24/06/22 22.25

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Polish Journal of Environmental Studies — 2 September 2022 16.05
Publishing fee has been set (PJOES-00324-2022-04)
To: Sudar Ningsih

Dear Dr. Sudarningsih Sudarningsih,

Publishing fee for the manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) has been set to: 561.00 EUR

The cost of bank transfer is on your side.

Please, do FILL IN INVOICE DATA in the Editorial System.
The invoice will be send to you after payment realization.

Please provide number of manuscript (PJOES-00324-2022-04) when transfering the payment.

Please, send the invoice data and proceed with the payment via manuscript view page:
https://www.editorialsystem.com/pjoes/article/302823/view/payment/

Bank wire transfer:
Name of Payee: Firma Wydawnicza HARD s.c. Jerzy Radecki, Hanna Radecka, Dorota Radecka
Address of Payee: ul. Wengris 71, 10-718 OLSZTYN, POLAND
Bank Name: Bank Polska Kasa Opieki SA
Bank Address: ul. 1 Maja 10, 10-118 Olsztyn, Poland
Title: Publishing fee PJOES-00324-2022-04
Payment 561.00 EUR to bank account no.:
PL19124015901111000014317981
Swift Reference: PKOPPLPW

The transfer of publication fee should be realized within 3 month. If this condition will be not fulfilled your manuscript will be withdrawn from the list of accepted articles.With kind regards,

Professor Hanna Radecka
Editor – in – Chief
Polish Journal of Environmental Studies
www.pjoes.com

06.09.2022 05:54 Sudarningsih Sudarningsih <sudarningsihunlam@gmail.com> napisał(a):

Dear Professor Hanna Radecka

I have tried to transfer our publishing fee using my Mobile Banking, but I have some problems. First, I can't use account no : PL19124015901111000014317981, but if I use it without the letters "PL", the process will succeed. Is it right if I don't use letters "PL" in the account? - you could don't use the "PL"

Second, I can't write a message on the invoice (ex: Publishing fee PJOES-00324-2022-04). May I write them in the name of the receiver? - Yes, but please send to this e- mail the payment confirmation

And third, is Bank Polska Kasa Opieki SA the same as Bank PEKAO SA? Because in my M-banking there is no name Bank Polska Kasa Opieki SA. - it is the same bank

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Full Name of beneficiary :
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Short name of beneficiary :
HARD Publishing Company s.c.
Address of beneficiary:
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POLAND
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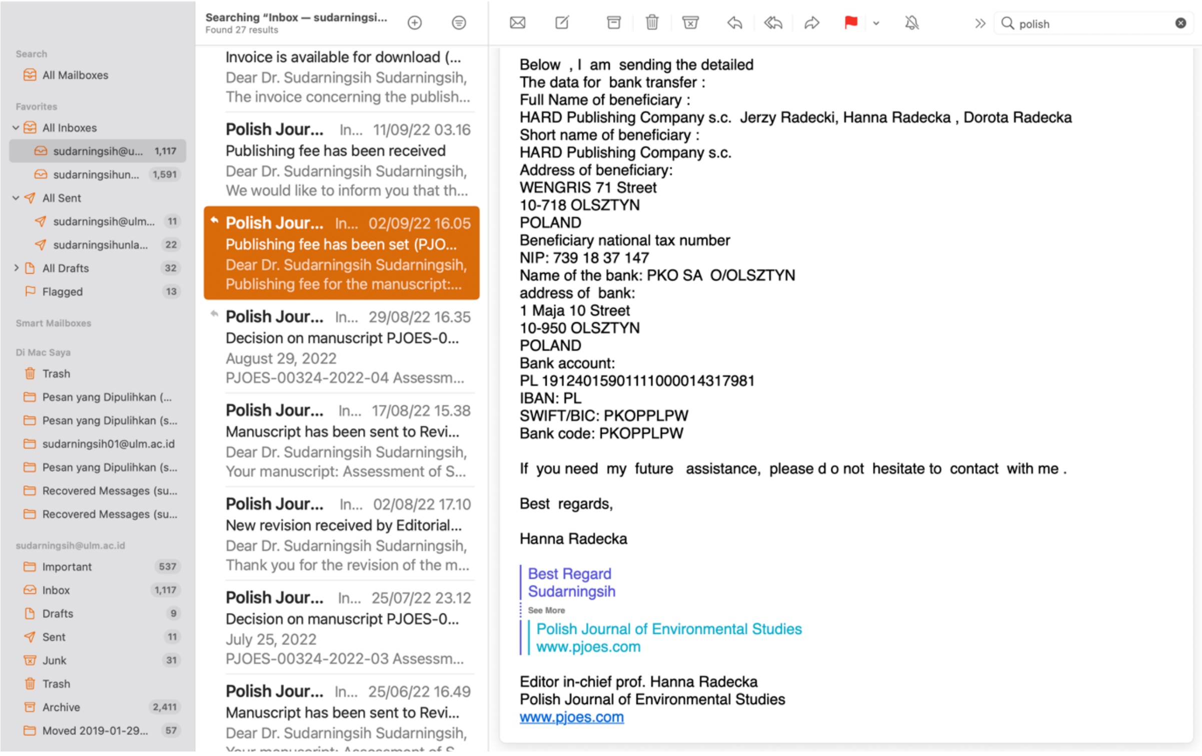

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Beneficiary national tax number
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address of bank:
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10-950 OLSZTYN
POLAND
Bank account:
PL 19124015901111000014317981
IBAN: PL
SWIFT/BIC: PKOPPLPW
Bank code: PKOPPLPW

If you need my future assistance, please d o not hesitate to contact with me .

Best regards,

Hanna Radecka

Best Regard
Sudarningsih

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Editor in-chief prof. Hanna Radecka
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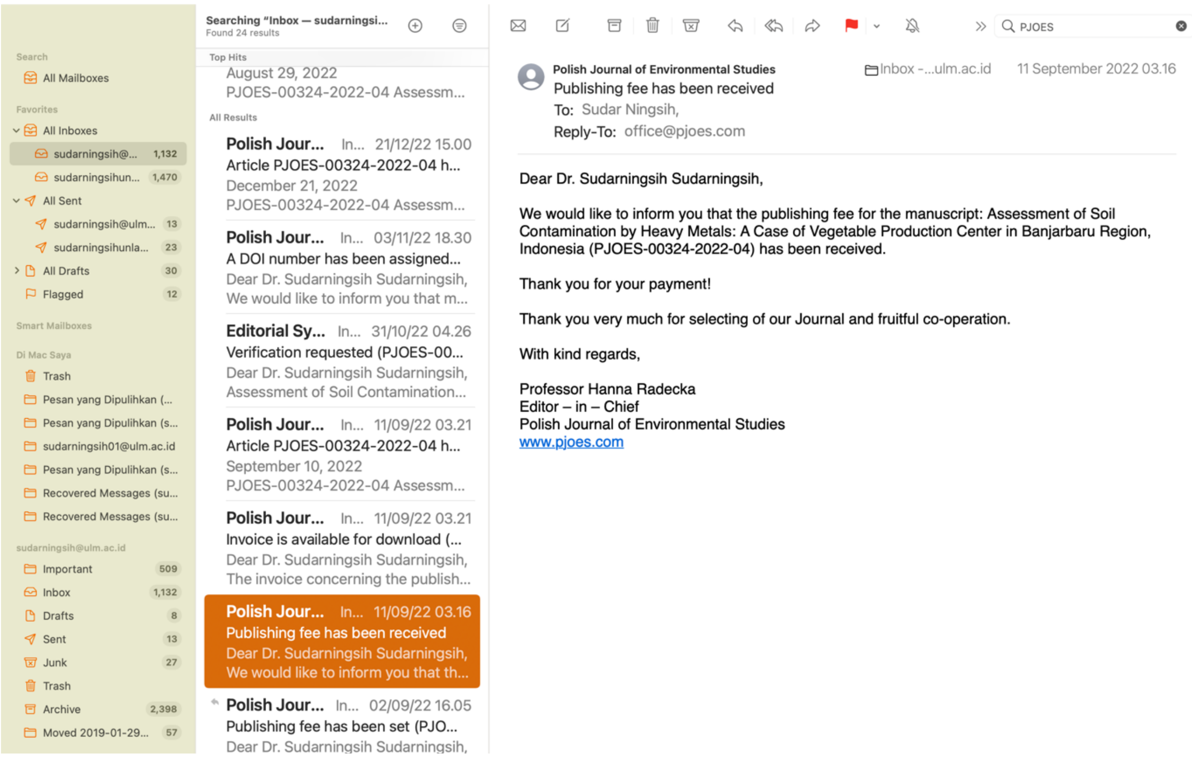


Polish Journal of Environmental Studies — Inbox -...ulm.ac.id — 11 September 2022 03.16
Publishing fee has been received
To: Sudar Ningsih,
Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

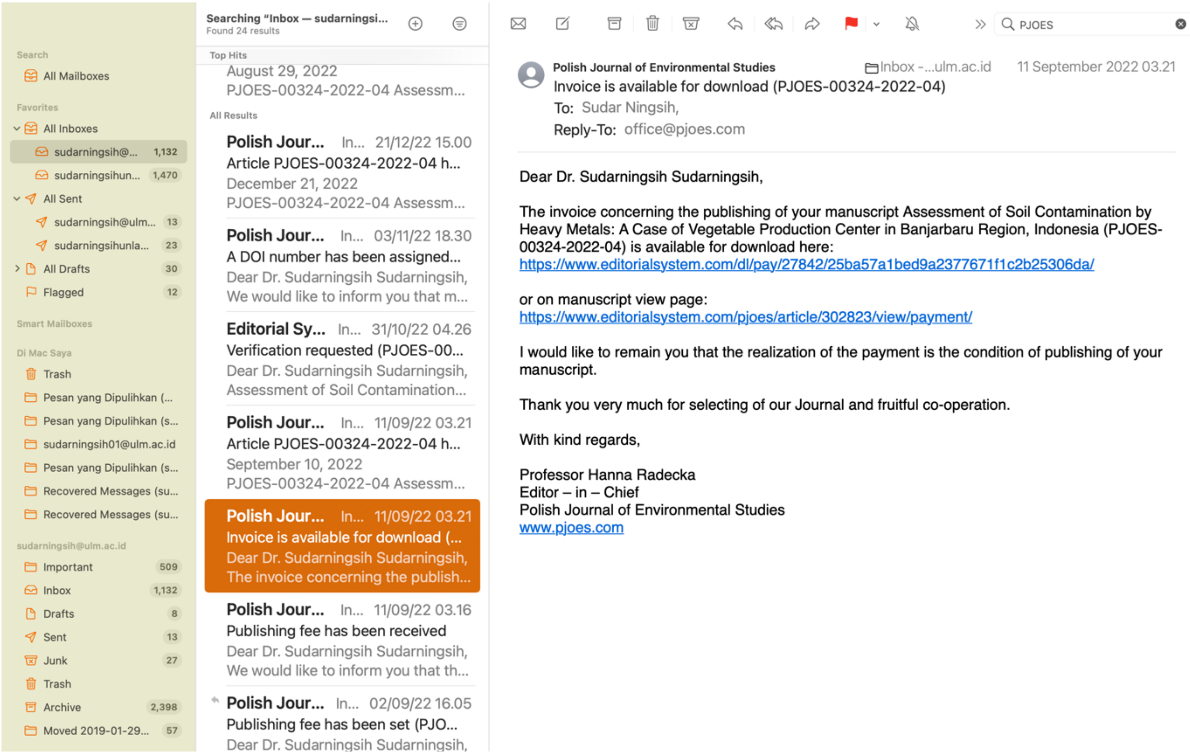
We would like to inform you that the publishing fee for the manuscript: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) has been received.

Thank you for your payment!

Thank you very much for selecting of our Journal and fruitful co-operation.

With kind regards,

Professor Hanna Radecka
Editor – in – Chief
Polish Journal of Environmental Studies
www.pjoes.com



Polish Journal of Environmental Studies — Inbox -...ulm.ac.id — 11 September 2022 03.21

Invoice is available for download (PJOES-00324-2022-04)

To: Sudar Ningsih,

Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

The invoice concerning the publishing of your manuscript Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) is available for download here:
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or on manuscript view page:
https://www.editorialsystem.com/pjoes/article/302823/view/payment/

I would like to remain you that the realization of the payment is the condition of publishing of your manuscript.

Thank you very much for selecting of our Journal and fruitful co-operation.

With kind regards,

Professor Hanna Radecka
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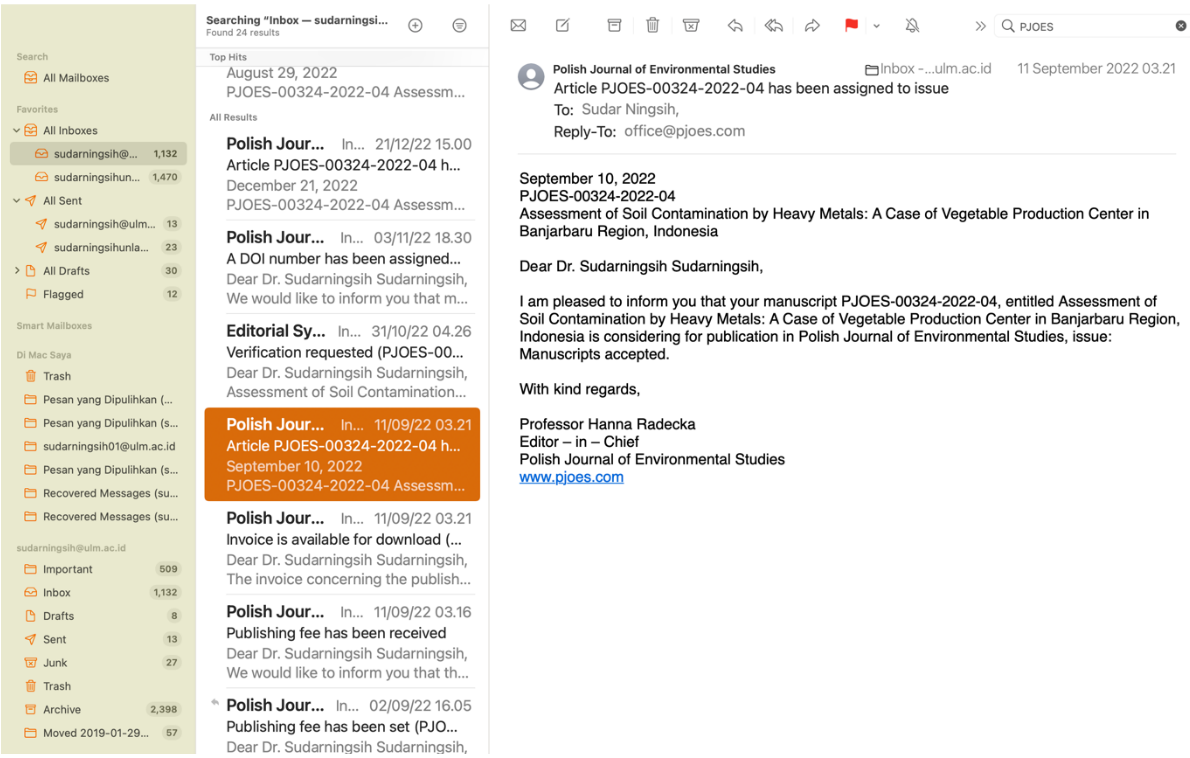

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Article PJOES-00324-2022-04 has been assigned to issue

To: Sudar Ningsih,

Reply-To: office@pjoes.com

September 10, 2022
PJOES-00324-2022-04
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript PJOES-00324-2022-04, entitled Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia is considering for publication in Polish Journal of Environmental Studies, issue: Manuscripts accepted.

With kind regards,

Professor Hanna Radecka
Editor – in – Chief
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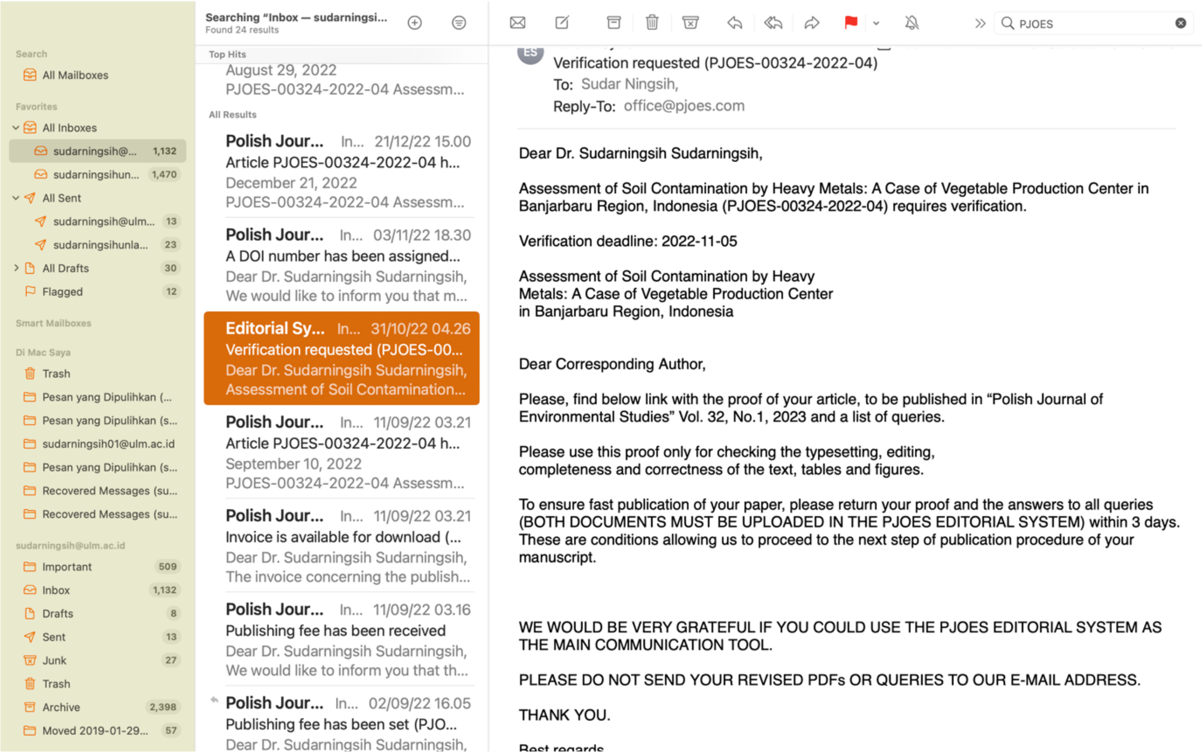


Verification requested (PJOES-00324-2022-04)
To: Sudar Ningsih,
Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) requires verification.

Verification deadline: 2022-11-05

Assessment of Soil Contamination by Heavy
Metals: A Case of Vegetable Production Center
in Banjarbaru Region, Indonesia

Dear Corresponding Author,

Please, find below link with the proof of your article, to be published in “Polish Journal of Environmental Studies” Vol. 32, No.1, 2023 and a list of queries.

Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures.

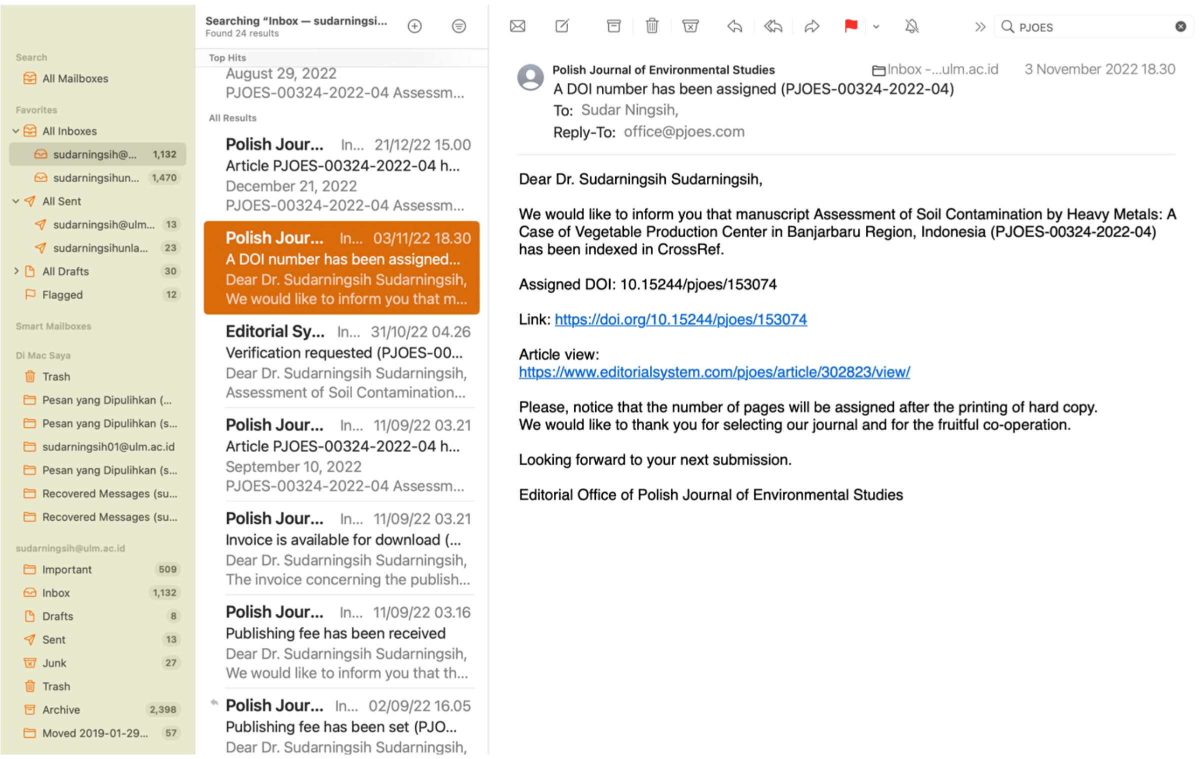
To ensure fast publication of your paper, please return your proof and the answers to all queries (BOTH DOCUMENTS MUST BE UPLOADED IN THE PJOES EDITORIAL SYSTEM) within 3 days. These are conditions allowing us to proceed to the next step of publication procedure of your manuscript.

WE WOULD BE VERY GRATEFUL IF YOU COULD USE THE PJOES EDITORIAL SYSTEM AS THE MAIN COMMUNICATION TOOL.

PLEASE DO NOT SEND YOUR REVISED PDFs OR QUERIES TO OUR E-MAIL ADDRESS.

THANK YOU.

Best regards



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A DOI number has been assigned (PJOES-00324-2022-04)
To: Sudar Ningsih,
Reply-To: office@pjoes.com

Dear Dr. Sudarningsih Sudarningsih,

We would like to inform you that manuscript Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia (PJOES-00324-2022-04) has been indexed in CrossRef.

Assigned DOI: 10.15244/pjoes/153074

Link: https://doi.org/10.15244/pjoes/153074

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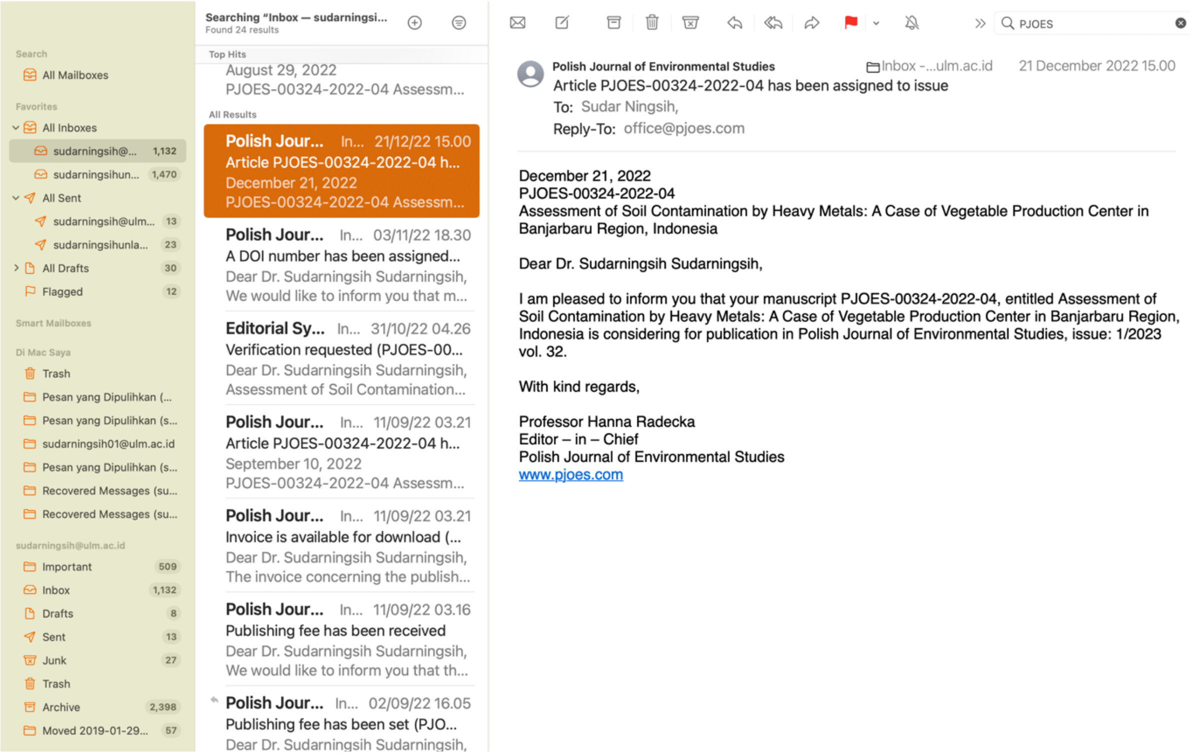
Please, notice that the number of pages will be assigned after the printing of hard copy.
We would like to thank you for selecting our journal and for the fruitful co-operation.

Looking forward to your next submission.

Editorial Office of Polish Journal of Environmental Studies



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Article PJOES-00324-2022-04 has been assigned to issue
To: Sudar Ningsih,
Reply-To: office@pjoes.com

December 21, 2022
PJOES-00324-2022-04
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript PJOES-00324-2022-04, entitled Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia is considering for publication in Polish Journal of Environmental Studies, issue: 1/2023 vol. 32.

With kind regards,

Professor Hanna Radecka
Editor – in – Chief
Polish Journal of Environmental Studies
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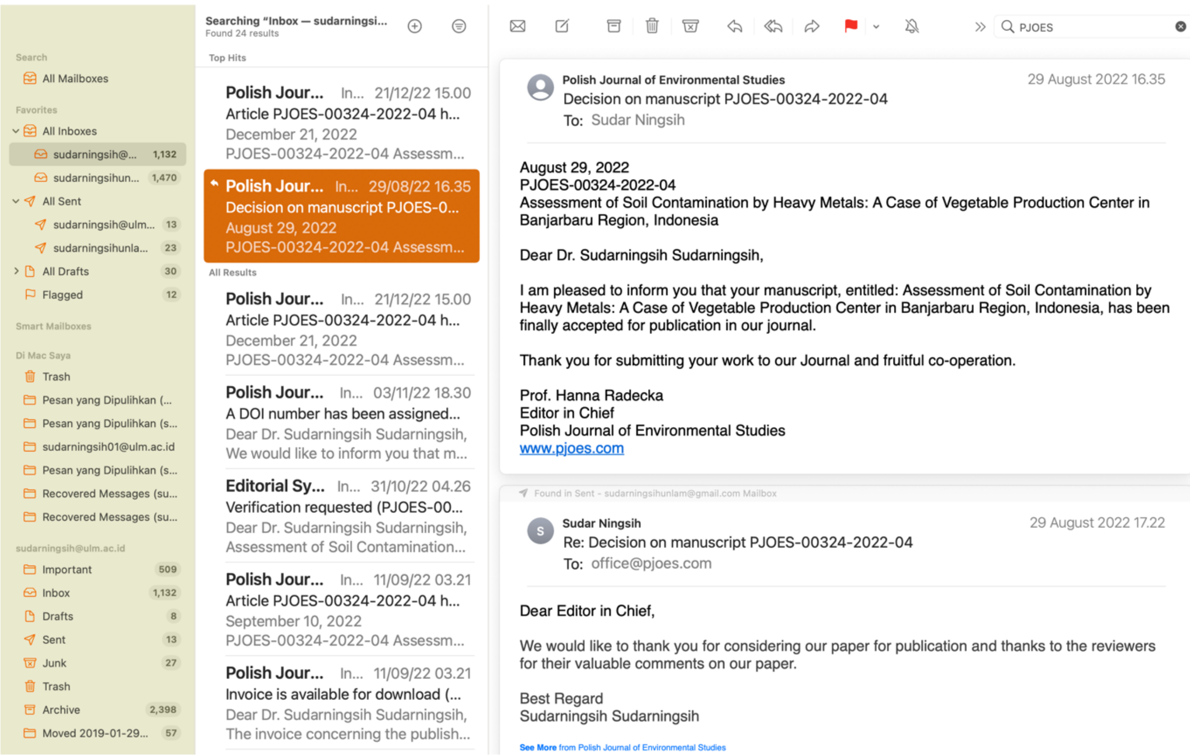

Polish Journal of Environmental Studies — 29 August 2022 16.35
Decision on manuscript PJOES-00324-2022-04
To: Sudar Ningsih

August 29, 2022
PJOES-00324-2022-04
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript, entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia, has been finally accepted for publication in our journal.

Thank you for submitting your work to our Journal and fruitful co-operation.

Prof. Hanna Radecka
Editor in Chief
Polish Journal of Environmental Studies
www.pjoes.com

Found in Sent – sudarningsihunlam@gmail.com Mailbox

Sudar Ningsih — 29 August 2022 17.22
Re: Decision on manuscript PJOES-00324-2022-04
To: office@pjoes.com

Dear Editor in Chief,

We would like to thank you for considering our paper for publication and thanks to the reviewers for their valuable comments on our paper.

Best Regard
Sudarningsih Sudarningsih

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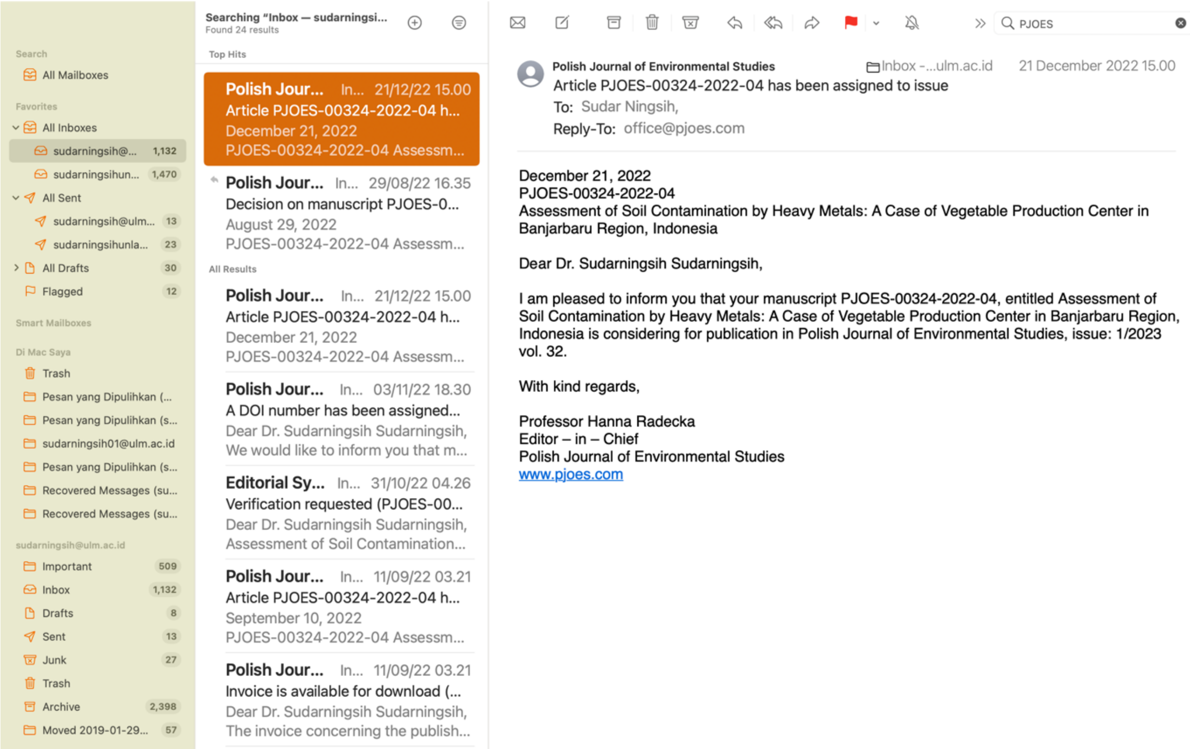

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Article PJOES-00324-2022-04 has been assigned to issue
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With kind regards,

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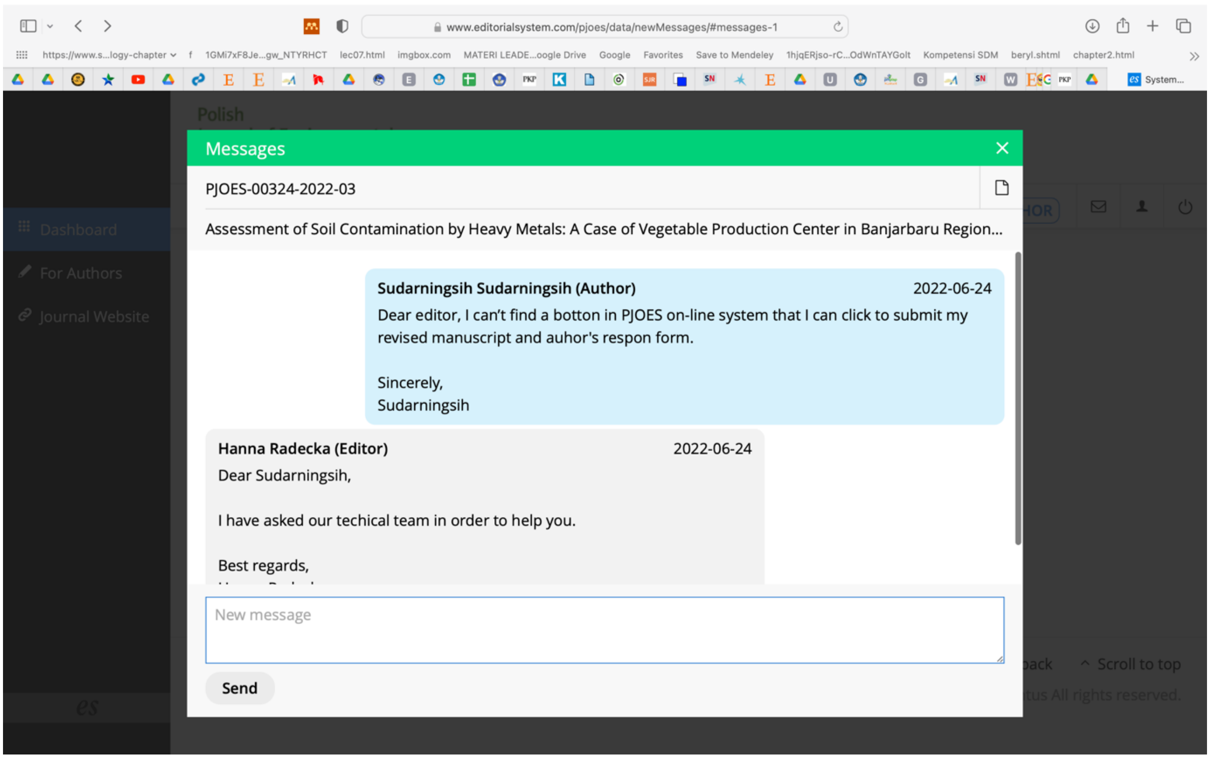

Messages

PJOES-00324-2022-03

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region...

Sudarningsih Sudarningsih (Author) 2022-06-24
Dear editor, I can't find a botton in PJOES on-line system that I can click to submit my revised manuscript and auhor's respon form.

Sincerely,
Sudarningsih

Hanna Radecka (Editor) 2022-06-24
Dear Sudarningsih,

I have asked our techical team in order to help you.

Best regards,

New message

Send

Polish
Journal of Environmental
Studies

Authors:

Sudarningsih Sudarningsih, Fahruddin Fahruddin, Muhammad Lailiyanto, Alif Noer, Sadang Husain, Simon Siregar, Sri Wahyono

Decision letter:

May 23, 2022
PJOES-00324-2022-01
Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Dear Dr. Sudarningsih Sudarningsih,

I am pleased to inform you that your manuscript, entitled: Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia, might be accepted for publication in our journal, pending changes suggested by reviewers (see below).

Please revise your manuscript strictly according to the attached Reviewers' comments as well as Editor's remarks. Your manuscript won't be taken into consideration without the revisions made according to the recommendations.

Please, check all Editor's remarks when revising your manuscript:
- R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way
- In references all authors name must be included
- E-mail address of Corresponding Author must be provided
- Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References

Please, provide the following items:
1) copy of the fully revised manuscript that has all the changes highlighted in red colour, along with high–quality figures. Each figure prepared in colour will be charged 60 EURO
2) answers to all the Reviewer comments

Authors of our journal are requested to prepare a revised version of their manuscript as soon as possible. This may ensure fast publication if an article is finally accepted.

Thank you for submitting your work to our Journal and fruitful co-operation.

With kind regards,

Dorota Radecka PhD
Executive editor
Polish Journal of Environmental Studies
www.pjoes.com

Polish
Journal of Environmental
Studies

Review 1:

How important do you consider the results reported?
important

Do the data obtained by experiment or calculation verify the conclusions?
Yes

Is the length of the manuscript appropriate to its contents?
Yes

The paper should be published as:
Original full paper

Detailed description:

English-Linguistic correctness: grammar, structure, vocabulary
Good

Abstract
Good

Introduction
Good

Figures (are all necessary ?)
Good

Tables (are all necessary ?)
Good

References
Good

Authors used only 12 samples which celarly is not statiscally significant. Some justification should be given on this,

Review 2:

How important do you consider the results reported?
less important

Do the data obtained by experiment or calculation verify the conclusions?
Yes

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Is the length of the manuscript appropriate to its contents?
Yes

The paper should be published as:
Original full paper

Detailed description:

English-Linguistic correctness: grammar, structure, vocabulary
Fair

Abstract
Fair

Introduction
Fair

Figures (are all necessary ?)
Not acceptable

Tables (are all necessary ?)
Fair

References
Fair

The manuscript should be corrected by removing unnecessary repetitions of data (the same data in Tables and in Figures) and detailed description of sites and sampling points should be added.

Summary, line 26 - why Zn is two times
Map with locations of sampling points needed
In how many repetitions analyses were conducted?
Line 107- Why division into site A and B was performed – what was the difference between thes two sites? Again map with marked Site A and B needed. Pleaese explain shortly this Rahman's method
Table 1. – the same number of decimals should be maintained.
Figures 1 – 3 – These are the same data as in Table 1, remove these Figures – they are incorrect, as far as I understand there isn't any conection between f.ex. point „0" in Site A and B, so it is inappropriate to show them as one bar.
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And again this is unecessary repetitions.

I suggest to expand description of both sites and sampling points and try to explain where such big differences in specific locations come from (f.ex. in site A1). Detailed

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description of the way of taking samples is needed.

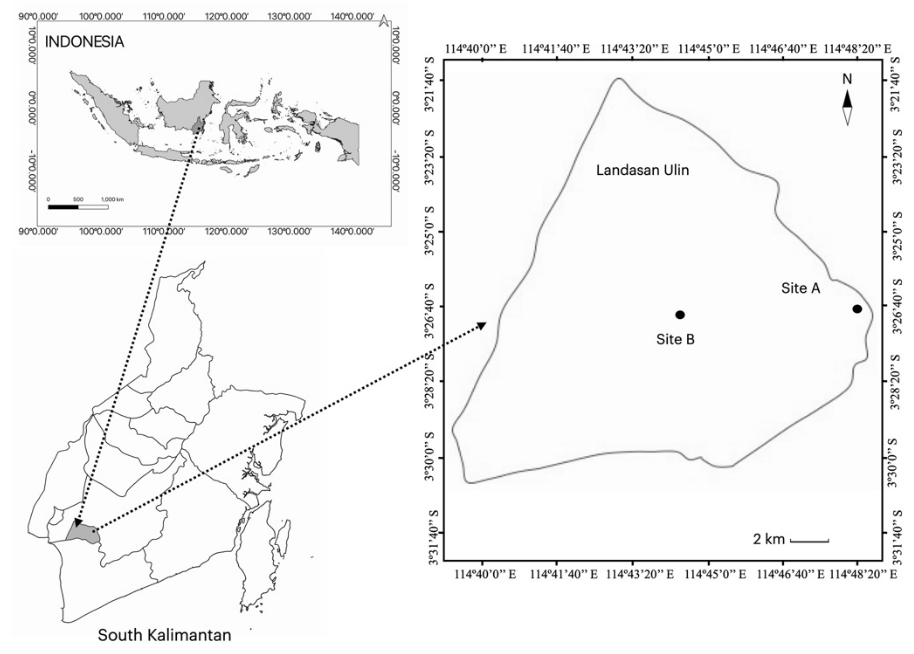
FIRST REVISION

Author's Respond Form

Manuscript ID	PJOES-00324-2022-01
Title	Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia
Authors	Sudarningsih Sudarningsih *, Fahruddin Fahruddin, Muhammad Lailiyanto, Alif Antasari Noer, Sadang Husain, Simon Sadok Siregar, Sri Cahyo Wahyono, Ichsan Ridwan
Submission date	05 March 2022
Revision date	26 May 2022
Reviewer	**2**

Editor's Evaluation	Details of Author's Respond	Modification
Editor's Comments	**Author's Respond**	
R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way	This has been revised accordingly	
In references all authors name must be included	This has been revised accordingly	
E-mail address of Corresponding Author must be provided	This has been revised accordingly	
Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References	This has been revised accordingly	
Answers to all the Reviewer comments	This has been revised accordingly	

Reviewers' Evaluation	Details of Author's Respond	Modification
Reviewer-1 Comments	**Author's Respond**	
Authors used only 12 samples which clearly is not statically significant. Some justification should be given on this.	This has been revised accordingly	See lines 105-108: Twelve agriculture soil samples were taken from two different area (Site A and site B) (Fig.1). Site A in Dahor Formation and site B in alluvial soil [20]. In general, agricultural soils in these two areas tend to be homogeneous with the chemical composition of the soil having low variability [19].

Reviewers' Evaluation	Details of Author's Respond	Modification
Reviewer-2 Comments	**Author's Respond**	
The manuscript should be corrected by removing unnecessary repetitions of data (the same data in Tables and in Figures) and detailed description of sites and sampling points should be added.	This has been revised accordingly	
Summary, line 26 - why Zn is two times	This has been revised accordingly	See line 26: The average concentration of heavy metals in the sampling area A is Fe>Zn>Mn>Cu>Hg, and the area B is Fe>Mn>Zn>Cu>Hg.
Map with locations of sampling points needed	We have added map with locations of sampling points.	See line 482: Figure 1:  Figure 1. The sampling site of agriculture soil from vegetable production center in Banjarbaru Region.

<table>
<tr>
<td>In how many repetitions analyses were conducted?</td>
<td>This has been revised accordingly</td>
<td>We have removed the figures.</td>
</tr>
<tr>
<td>Line 107- Why division into site A and B was performed – what was the difference between thes two sites? Again map with marked Site A and B needed. Pleaese explain shortly this Rahman’s method</td>
<td>This has been revised accordingly</td>
<td>See line 482:
Figure 1. The sampling site of agriculture soil from vegetable production center in Banjarbaru Region.

See line 108-113:
These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21].</td>
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<td>Table 1. – the same number of decimals should be maintained.</td>
<td>This has been revised accordingly</td>
<td>See line 418:
Table 1:
<table>
<tr><th rowspan="2">Sample</th><th>Fe</th><th>Zn</th><th>Mn</th><th>Cu</th><th>Hg</th><th rowspan="2">χ_{lf} (× 10^{-8} m^3kg^{-1})</th></tr>
<tr><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th></tr>
<tr><td colspan="7">Sampling Area A</td></tr>
<tr><td>A0</td><td>28,600.00</td><td>156.00</td><td>112.00</td><td>49.00</td><td>0.12</td><td>136.50</td></tr>
<tr><td>A1</td><td>28,100.00</td><td>124.00</td><td>161.00</td><td>147.00</td><td>0.12</td><td>135.60</td></tr>
<tr><td>A2</td><td>27,300.00</td><td>77.00</td><td>60.00</td><td>70.00</td><td>0.08</td><td>100.10</td></tr>
<tr><td>A3</td><td>26,900.00</td><td>57.00</td><td>52.00</td><td>70.00</td><td>0.11</td><td>135.60</td></tr>
<tr><td>A4</td><td>31,800.00</td><td>65.00</td><td>70.00</td><td>89.00</td><td>0.09</td><td>47.30</td></tr>
<tr><td>A5</td><td>30,400.00</td><td>71.00</td><td>81.00</td><td>91.00</td><td>0.11</td><td>44.80</td></tr>
<tr><td>Min</td><td>26,900.00</td><td>57.00</td><td>52.00</td><td>49.00</td><td>0.08</td><td>44.80</td></tr>
<tr><td>Max</td><td>31,800.00</td><td>156.00</td><td>161.00</td><td>147.00</td><td>0.12</td><td>136.50</td></tr>
<tr><td>Mean</td><td>28,850.00</td><td>91.67</td><td>89.33</td><td>86.00</td><td>0.10</td><td>100.00</td></tr>
<tr><td>SD</td><td>1,893.94</td><td>39.00</td><td>41.00</td><td>34.00</td><td>0.01</td><td>44.03</td></tr>
<tr><td colspan="7">Sampling Area B</td></tr>
</table>
</td>
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<table>
<tr><td>B0</td><td>2,500.00</td><td>20.00</td><td>38.00</td><td>7.00</td><td>0.01</td><td>23.30</td></tr>
<tr><td>B1</td><td>1,500.00</td><td>21.00</td><td>23.00</td><td>7.00</td><td>0.04</td><td>21.00</td></tr>
<tr><td>B2</td><td>1,000.00</td><td>65.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>24.30</td></tr>
<tr><td>B3</td><td>8,200.00</td><td>14.00</td><td>68.00</td><td>12.00</td><td>0.01</td><td>1.10</td></tr>
<tr><td>B4</td><td>4,800.00</td><td>14.00</td><td>39.00</td><td>9.00</td><td>0.01</td><td>1.90</td></tr>
<tr><td>B5</td><td>1,000.00</td><td>20.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>1.60</td></tr>
<tr><td>Min</td><td>1,000.00</td><td>14.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>1.10</td></tr>
<tr><td>Max</td><td>8,200.00</td><td>65.00</td><td>68.00</td><td>12.00</td><td>0.04</td><td>24.30</td></tr>
<tr><td>Mean</td><td>3,166.67</td><td>25.67</td><td>33.00</td><td>7.50</td><td>0.01</td><td>12.20</td></tr>
<tr><td>SD</td><td>2,850.03</td><td>19.52</td><td>20.17</td><td>2.66</td><td>0.01</td><td>11.74</td></tr>
<tr><td>Baseline</td><td>4.72</td><td>95.00</td><td>850.00</td><td>45.00</td><td>0.40</td><td>-</td></tr>
</table>
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<tr>
<td>Figures 1 – 3 – These are the same data as in Table 1, remove these Figures – they are incorrect, as far as I understand there isn’t any connection between f.ex. point „0” in Site A and B, so it is inappropriate to show them as one bar.</td>
<td>We have removed the figures.</td>
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<td>We have removed Figure 4.</td>
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<td>This has been revised accordingly</td>
<td>See line 181-185:
At site A, the content of Mn and Cu at point A1 is higher than at other points which are suspected come from fertilizers and pesticides [36], also from traffic waste [28, 29], as well as Zn. This is known based on the location of point A1 which is closest to the highway. In addition, the high content of Mn at point A1 is thought to also originate from the post-harvest processing of agricultural land [38].</td>
</tr>
<tr>
<td>Description of the way of taking samples is needed.</td>
<td>This has been revised accordingly</td>
<td>See line 108-113:
These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21].</td>
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Original research

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Keywords
contamination factor, geoaccumulation index, pollution load index, contamination degree

Abstract
Landasan Ulin is a center for vegetable production, and it has an important role in producing vegetables for the city of Banjarbaru. Agricultural soil in this study was assessed for heavy metal contamination using the geoaccumulation index (Igeo), contamination factor (Cfi), the degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI) as well as magnetic susceptibility. Samples were collected from topsoil and analyzed using magnetic susceptibility and Atomic Absorption Spectrophotometer (AAS). The average concentration of heavy metals in the sampling area A is Fe>Zn>Mn>Cu>Hg, and the area B is Fe>Mn>Zn>Cu>Hg. Magnetic susceptibility values in area A is higher than in area B and the value of magnetic susceptibility can be used as a proxy for monitoring heavy metal concentrations, especially Zn in this area. Zn and Cu exceeded the threshold set by the Indonesian Standards Institute. Igeo results show that the research area is moderately contaminated with Cu, Zn, and Hg. According to Cfi, the soil was classified as low contaminated with Fe, Zn, Cu, Mn, and Hg, as well as Cd and mCd. The PLI results show that in both area, drastic corrective action is not required.

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Explanation letter
This is s file of author's respon form.

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Type of the Paper (Article, Review, Short Communication.)

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

Sudarningsih Sudarningsih *, Fahruddin Fahruddin, Muhammad Lailiyanto, Alif Antasari Noer, Sadang Husain, Simon Sadok Siregar, Sri Cahyo Wahyono, Ichsan Ridwan

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Received:

Accepted:

Abstract:

Landasan Ulin is a center for vegetable production, and it has an important role in producing vegetables for the city of Banjarbaru. Agricultural soil in this study was assessed for heavy metal contamination using the geoaccumulation index (Igeo), contamination factor (C_f^i), the degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI) as well as magnetic susceptibility. Samples were collected from topsoil and analyzed using magnetic susceptibility and Atomic Absorption Spectrophotometer (AAS). The average concentration of heavy metals in the sampling area A is Fe>Zn>Mn>Cu>Hg, and the area B is Fe>Mn>Zn>Cu>Hg. Magnetic susceptibility values in area A is higher than in area B and the value of magnetic susceptibility can be used as a proxy for monitoring heavy metal concentrations, especially Zn in this area. Zn and Cu exceeded the threshold set by the Indonesian Standards Institute. Igeo results show that the research area is moderately contaminated with Cu, Zn, and Hg. According to C_f^i, the soil was classified as low contaminated with Fe, Zn, Cu, Mn, and Hg, as well as Cd and mCd. The PLI results show that in both area, drastic corrective action is not required.

Keywords: geoaccumulation index; contamination factor; contamination degree; pollution load index

Introduction

Heavy metal contamination of agricultural soil due to chemical fertilizers and pesticides is a serious ecological problem today [1, 2]. In agricultural soil, the continuous use of manure and chemical fertilizers for a long time will result in higher heavy metal content [3, 4]. Some heavy metals are needed for the growth of certain plants [5], but some of them for humans can be toxic. When these heavy metals are absorbed and accumulated by plants and then consumed by humans, this will pose a risk to the human body [6].

Some heavy metals have been found in agricultural land in several areas in Indonesia, such as Pb found in soil from 168 locations with different land use and traffic conditions in Yogyakarta, Indonesia [7]. In Semarang, Indonesia, the paddy field contains heavy metals Pb, Cd, and Cu [8]. In agricultural land in Karawang, Pb and Cd were found with concentrations exceeding 1.0 ppm [9]. Meanwhile, in agricultural soils in Bangladesh for the dry season, heavy metals were found with concentrations of As>Fe>Hg>Mn>Zn>Cu>Cr>Ni>Pb>Cd and in the rainy season As>Fe>Mn>Zn>Hg>Cu>Ni>Cr>Pb>Cd [10]. In paddy soils at Hunan Province, China, there was founded heavy metals (Cd, Cr, As, Ni, Mn, Pb, and Hg) in three different locations [11].

The presence of magnetic minerals in the soil can come from weathering of the parent rock (lithogenic origin) and can also come from human activities (anthropogenic). Magnetic minerals that are commonly found in soil are hematite and magnetite. Their presence is in the form of solid waste which can act as the main absorber of pollutants such as heavy metals in the soil. Their presence in the soil will affect the value of the magnetic susceptibility of the soil. The use of magnetic susceptibility has been widely used in various soil science studies, such as soil morphology and genesis as well as tools for mapping the distribution of environmental pollutants [12]. Magnetic susceptibility measurement has been considered as a fast and cheapest monitoring tool for determining the spatial distribution of heavy metal presence in soil and can be used as a proxy for chemical methods [13]. Research using the method of environmental magnetism in Indonesia is still few in number. Several studies were conducted to examine the river and lake environment [14–17] Therefore, this study is very important.

Landasan Ulin is a vegetable center production in Banjarbaru City, South Kalimantan, Indonesia. Agricultural activities in this area are carried out by farmers traditionally [18]. Meanwhile, agricultural land has the potential to experience heavy metal pollution, and studies on heavy metal pollution in agriculture in this area are still rarely carried out. Therefore, it is very important to conduct this research to determine the current status of the presence of these heavy metals on the surface of agricultural soil. This will be of benefit to ameliorate the impacted environmental problems further, and to adopt mitigation strategies in the future. This study aims to investigate the level of contamination of various heavy metals (Fe, Mn, Cu, Zn, Hg) in agricultural land located in Landasan Ulin, South Kalimantan, Indonesia, using different indices such as geoaccumulation index, pollution factor, degree of pollution, and the pollution load index. The correlation between heavy metal contamination and magnetic susceptibility is also investigated in this study. These results can be used as an alternative method in determining heavy metal contamination in agricultural areas. This approach will help monitor the presence of heavy metals in agricultural soils and soil remediation. Monitoring for polluted areas is crucial, and it is beneficial for the sustainability of pollution management and control in the future.

Materials and Methods

Study Area

Sampling and Measurements

Index of Geoaccumulation, Contamination Factor (C_f^i), Degree of Contamination (Cd) and Pollution Load Index (PLI)

Landasan Ulin, South Kalimantan Province, Indonesia, has a 92.42 km2 area, consisting of mountains and hills in the north and east, and lowlands to the west, while the south has alluvium and swamp areas. Landasan Ulin is about 40 km from the provincial capital, Banjarmasin. Landasan Ulin is a vegetable production area in South Kalimantan. The cultivated vegetables from the area include mustard greens, kale, spinach, eggplant, lettuce, long beans, peanuts, and scallions. One of the efforts to increase the yield and quality of vegetables is through fertilization. Both organic and inorganic fertilizers are applied. The used dose of organic fertilizer was 485 kg, or an average of 16.17 kg/farmer, while the inorganic fertilizer was 556 kg, or an average of 18.53 kg/farmer. Nitrogen (N) fertilizer is critical for the growth of vegetables. The crops are never separated from the disturbance of weeds and pests. Theoretically, weeds are bothering vegetable growth because they are competitive in many ways, especially in getting water, sunlight, and nutrients. Weeds also, in some cases, become the source of the disease that often becomes a significant threat to the corps. To manage the growth of weeds, farmers do the chemical control of weeds regularly by using Gramoxon. About 400 liters is enough to kill weeds on an average of 13.33 liters/respondent. Removing the weeds can also be done manually by using physical measures or machinery. Meanwhile, in overcoming pests and diseases in North Landasan Ulin Village, the farmers used Ampligo, one of the pesticide brands. It is sprayed regularly with a dose that ranges from 20 liters or an average of 0.67 liters/farmer to kill/destroy pests that stick around the leaves and stems of mustard greens [19].

Twelve agriculture soil samples were taken from two different area (Site A and site B) (Fig.1). In general, agricultural soils in these two areas tend to be homogeneous, with the chemical composition of the soil having low variability [19]. But geologically, these two areas are in two different formations. Site A is in the Dahor Formation and Site B is in alluvial soil [20]. That is why this research is divided into two different research areas. These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one

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location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21]. In the laboratory, the soil sample was dried by aerating at room temperature. The dry soil samples were sieved using a 325 mesh-size sieve (44 µm in diameter) to obtain homogeneous soil particles. 2–3 g dry soil samples were digested in about 15 mL of aqua-regia (HCL: HNO3 = 3:1) for about 4–5 hours on a hotplate set to 110 °C. The materials were then diluted to 50 mL in a 100 mL Pyrex glass beaker with distilled water. In the laboratory of the Indonesian Geological Survey in Bandung, Indonesia, by AA280FS Atomic Absorption Spectrometer (AAS) (Variant Inc. Palo Alto, USA), the solution was filtered, and the filtrates were examined. The working standard solutions for each metal were prepared before every analysis. An air acetylene flame AAS was used to measure Fe, Zn, Cu, Pb, and Mn concentrations, with As determined by hydride vapor generation AAS. Magnetic susceptibility measurement was carried out in the following way, the dried soil sample was put into a cylindrical plastic holder with a diameter of 25.4 mm and a height of 22 then measured using a Susceptibilitymeter (Bartington Instrument Ltd., Oxford, UK). Each sample was measured with three repetitions. The magnetic susceptibility value used is the average value of the results of this measurement [13].

To analyze the level of heavy metal pollution in an area, more than one pollution index analysis is needed (3, 21, 36, 37), so in this study 5 pollution indices were used, namely the geoaccumulation index (I_{geo}), contamination factor (C_{fi}), the degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI). The five pollution indices are expected to provide more accurate information on the level of pollution in this research area.

Müller's geoaccumulation index (Igeo) [22], which was originally established to measure contamination of sedimentary bottoms, may now be used to assess soil contamination. It's calculated using equation (1) as follows:

$$I_{geo} = \log_2 \frac{C_n}{1.5B_n} \quad (1)$$

Cn is the element's observed concentration in the pelitic sedimentary fraction (<2 m), and Bn is the geochemical background value based on argillaceous sedimentary fossils (shale mean). C_f^i and C_d are indices that can be used to assess soil contamination which consists of four classes [23]. Equation (2) was utilized in the following way:

$$C_f^i = \frac{C_0^i}{C_r^i} \quad (2)$$

C_0^i is the pre-industrial concentration of the specific metal, and C_n^i is the mean content of metals from at least five sampling sites. As a result, the computed C_d is defined as the amount of C_f^i determined by Hakanson for the polluting species [23]. The following is the equation used to calculate C_d

$$C_d = \sum_{i=1}^{n} C_f^i \quad (3)$$

C_d is intended to measure the overall level of contamination in the surface layer at a particular sampling site. In this study, we applied a factor modification as applied by Krzysztof [24]. Abrahim [25] proposes the following modified and generalized version of the Hakanson equation [23] for estimating the total degree of contamination at a sample or coring location. Equation 4 is a modified equation for the general approach to calculating contamination levels.

$$mC_d = \frac{\sum_{i=1}^{i=n} C_f^i}{n} \quad (4)$$

Where n denotes the number of elements to be examined and the contamination factor is abbreviated as C_f^i. Using this formula to compute mC_d allows metals to be incorporated into studies with no upper limit. To identify pollution, Tomlinson created the pollutant load index (PLI) [26]. This index allows for comparisons of pollution levels between sites and across time. The PLI was calculated as a concentration factor for each heavy metal in relation to the soil background value. The background for the heavy metal in this investigation was the average world concentration of the examined metal reported for shale [27]. PLI can assess the level of metal contamination and the actions that must be taken. The formulas used are in the form of equations (5).

$$\mathrm{PLI} = \mathrm{n}\sqrt{C_{f1} \times C_{f2} \times \ldots \times C_{fn}} \quad (5)$$

Results and Discussion

Heavy metal Content and Magnetic susceptibility

Soil Pollution Degree

Correlation Between Heavy Metal Content and Magnetic Susceptibility

Table 1 shows the average concentrations of a number of metals in the agricultural soils of the study area. The average Fe, Zn, Mn, Cu, and Hg concentrations in study area A were 28,850.00, 91.67, 89.33, 86.00, and 0.10 mg/kg. The average amounts of Fe, Zn, Mn, Cu, and Hg in B were 3,166.00, 25.67, 33.00, 7.50, and 0.01 mg/kg, respectively. Metal trends in research area A are Fe>Zn>Mn>Cu>Hg. Meanwhile, the trends of metals according to the average concentration in study area B is: Fe>Mn>Zn>Cu>Hg. Due to the agronomic practice, the concentration of heavy metals in study area B was various. Meanwhile, metal concentration trends in study area B are as follows: Fe>Mn>Zn>Cu>Hg. The concentration of heavy metals in study area B varied due to agronomic practices. The low heavy metal concentration in the soil can be attributed to the constant elimination of heavy metals by vegetables grown in the designated regions [21]. Table 1 also includes the magnetic susceptibility values of the samples from areas A and B. In general, the magnetic susceptibility values of area A (100.0×10^{-8} m^3kg^{-1}) were 9 times greater than those of area B (12.2×10^{-8} m^3kg^{-1}). Magnetic susceptibility of sampling area A ranges from 44.8 to 136.5×10^{-8} m^3kg^{-1}, while magnetic susceptibility of sampling area B ranges from 1.1 to 24.3×10^{-8} m^3kg^{-1}. Agricultural practices, such as the use of magnetic minerals such as Fe in fertilizers and pesticides, can increase the magnetic mineral content of agricultural soil. Magnetic minerals in agricultural soil can also be found in household waste. As is well known, the research site, area A, is located very close to settlements, whereas area B is located far from settlements. Household waste contains anthropogenic magnetic minerals, which can raise the magnetic susceptibility value [28].

The content of Mn and Cu at point A1 in area A is higher than at other points, which are suspected to be from fertilizers and pesticides [36], as well as traffic waste [28, 29] and Zn. This is known because of the proximity of point A1 to the highway. Furthermore, the high Mn content at point A1 is thought to be the result of post-harvest processing of agricultural land [38].

The average Igeo and contamination levels of several metals in soil are shown in Table 2. Igeo is highly variable, implying that the soil surrounding the sampling area was uncontaminated to moderately contaminated in terms of the metals tested. The average concentration of heavy metals was higher in study area A than in site B. Long-term use of machine tools, paints, pigments, and industrial equipment in the study area may have caused the highest Fe content in the soil [10]. The average concentration of Zn, Mn, Cu, and Hg found in study area A was also higher than in study area B. The presence of heavy metals in this area was suspected due to agricultural practices. Pesticides contain the elements Mn, Zn, and Cu (Cu, As, Hg, Pb, Mn, and Zn). Fungicides contain the elements Cu, Zn, and Mn. Compost and manure also contain Zn and Cu. Seed dressings contain Hg [30-32].

Zn is present in all sampling points at study area A, but not all sampling points at location B. Zn concentrations were approximately three times higher in sampling points at site A than in sampling points at site B. The average Zn concentration at sites A and B exceeded the 0.06 mg/kg threshold set by the Indonesian National Standardization Agency. However, the Zn concentration at these two sites was still low when compared to agricultural soils in Shenzhen, China (concentration average of 194 mg/kg in the dry season and 209 mg/kg in the rainy season) [33], soil in an unpolluted area of Gebze, China (concentration average 632 mg/kg) [34], and agricultural soil from Huanghuai Plain, China (74 mg/kg) [35]. In contrast to Zn, Cu was distributed over all sampling points in both study locations, and the concentration in site A was ten times higher than in site B.

The average Cu concentration in both locations also exceeded the 0.04 mg/kg threshold set by the Indonesian National Standardization Agency. However, the concentration of Cu at these two locations was still low when compared to agricultural soils in Shenzhen, China (with an average of 60 mg/kg in the rainy season and 90 mg/kg in the dry season) [33], as well as soils in unpolluted areas in Gebze, China (concentration average 95.88 mg/kg) [34], palm farms' soil in Morocco (concentration average 138 mg/kg) [36], and agricultural soil from Patuakhali District, Bangladesh (4.1–181 mg/kg) [37]. However, the Cu content at Site A was higher than the Cu content in agricultural soils in the Dumuria Upazila, Bangladesh [38] and Marrakech, Morocco [39] areas, whereas the Cu content at Site B was lower than the Cu content in agricultural soils in the Dumuria Upazila, Bangladesh (concentration average 17.70 mg/kg) and Marrakech, Morocco. Cu concentrations are higher in these two locations than in agricultural soils from Jeddah, Arab Saudi Arabia (concentration average 0.4 mg/kg) [40].

Hg concentrations were four times higher in site A than in site B. The presence of Hg was suspected to be the result of fungicide use. Hg in soil can be produced by a number of activities, including basic metal processing, some chemical sector activities, mining, and industrial waste. Hg concentrations in Gebze soil ranged from 9 to 2.721 g/kg, with an average of 102 g/kg [34], which is significantly higher than the concentrations found in this study. The Hg content of agricultural soils in China's Gorges Dam area is similar to that of this study area (0.08 mg/kg) [41]. Hg levels in sites A and B did not exceed the 0.5 mg/kg threshold for its presence in soil. According to this research, the concentration of heavy metals in site A is higher than in site B. According to observations and interviews with local farmers, site A was used for plantation activities much earlier than site B. Heavy metals accumulate in the soil over time due to a variety of factors, including the use of fertilizers, pesticides, and agricultural equipment [42, 43].

C_f was used to determine the overall contamination of the analyzed agricultural soil. The soil was classified as having a low contamination factor in both test regions, indicating low contamination with Fe, Zn, Mn, Cu, and Hg. The maximum contamination degree (C_d) values indicated a low level of contamination. As proposed in this work, the mC_d is calculated by combining and averaging all available analytical data for a collection of soil samples.

As a result, this improved method may provide a thorough assessment of the overall enrichment and contamination impact of various pollutant groups in the soil. In both sampling areas, the mC_d ranged from 0.48 to 0.10, indicating nil to a very low level of contamination. The PLI values indicated that drastic rectification measures are not needed in both areas. Table 3 shows the soil's average C_f^i, C_d, mC_d and PLI.

Pearson correlation analysis [44] was used to compare all of the variables. Table 4 displays the correlation coefficients between metal pairs. High correlation values (R>0.50) between different metal pairs, indicating soil accumulation. In soil samples from sampling area A, Mn-Zn (R=0.770), Cu-Mn (R=0.656), Hg-Zn (R=0.600), and Hg-Mn (R=0.600) had high correlation values (R> 0.5). The correlation trends in sampling area B were: Fe-Mn (R=0.965), Fe-Cu (R=0.977), and Cu-Mn (R=0.964).

Significant correlations indicate that they are thought to be anthropogenic, originating in agricultural activities such as the use of fertilizers and pesticides. Both of these areas are about 2 kilometers from Syamsuddin Noer airport, which is thought to contribute to heavy metal accumulation in the soil in this area [45]. Table 4 also shows the correlation coefficient between each heavy metal content and magnetic susceptibility measured in the same soil plane. According to the correlation analysis of each plot of land, several heavy metals show a positive correlation with magnetic susceptibility values, namely Zn (R=0.555), Mn (R=0.392), and Hg (R=0.490) in area A, and Zn (R=0.595) and Hg (R=0.367) in area B. When compared to other heavy metals, the content of the heavy metal Zn in both soil planes showed a stronger positive correlation coefficient with magnetic susceptibility. In both sampling areas, heavy metals such as Fe and Cu have negative correlation coefficient values with magnetic susceptibility.

Conclusions

In the biosphere, the soil is an essential component, every harmful change of it can seriously affect the quality of human life. It is very possible to have heavy metals content in the soil. Heavy metals that enter the food chain are the most detrimental because they can threaten human health. Some of the agricultural lands in Landasan Ulin, Banjarbaru, South Kalimantan are observed in this study. The lands were evaluated for the impact of anthropogenic heavy metals by using several indices that showed that study area A was not contaminated until moderately contaminated by different metals. Meanwhile, study area B did not show any contamination based on all indices. However, the presence of Cu and Zn in this region has exceeded the threshold set by the Indonesian National Standardization Agency, and this must be watched out for. For this reason, regular monitoring of heavy metals in agricultural land is necessary to ensure environmental quality. In addition, remediation measures need to be carried out on agricultural land indicated to be contaminated by Cu and Zn. This study also shows that magnetic susceptibility can be used as a proxy for monitoring the concentration of heavy metal especially Zn in agricultural soil in the Landasan Ulin area.

Acknowledgements

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List of Tables

Table 1. Different heavy metal concentrations and magnetic susceptibility in the study area's agricultural soil Add a descriptive label of the table here.

Table 2. Average I_{geo} and contamination levels of the soil in two sampling areas.

Table 3. Average C_f^i, C_d, mCd, and PLI of soil over two sampling areas.

Table 4. Pearson correlation (R) between heavy metal contents and magnetic susceptibility. The value of R for strong (above 0.5) correlation is in bold.

[

Sample	**Fe (mg/kg)**	**Zn (mg/kg)**	**Mn (mg/kg)**	**Cu (mg/kg)**	**Hg (mg/kg)**	**χ_{lf} (× 10^{-8} m^3kg^{-1})**
Sampling Area A						
A0	28,600.00	156.00	112.00	49.00	0.12	136.50
A1	28,100.00	124.00	161.00	147.00	0.12	135.60
A2	27,300.00	77.00	60.00	70.00	0.08	100.10
A3	26,900.00	57.00	52.00	70.00	0.11	135.60
A4	31,800.00	65.00	70.00	89.00	0.09	47.30
A5	30,400.00	71.00	81.00	91.00	0.11	44.80
Min	26,900.00	57.00	52.00	49.00	0.08	44.80
Max	31,800.00	156.00	161.00	147.00	0.12	136.50
Mean	28,850.00	91.67	89.33	86.00	0.10	100.00
SD	1,893.94	39.00	41.00	34.00	0.01	44.03
Sampling Area B						
B0	2,500.00	20.00	38.00	7.00	0.01	23.30
B1	1,500.00	21.00	23.00	7.00	0.04	21.00
B2	1,000.00	65.00	15.00	5.00	0.01	24.30
B3	8,200.00	14.00	68.00	12.00	0.01	1.10
B4	4,800.00	14.00	39.00	9.00	0.01	1.90
B5	1,000.00	20.00	15.00	5.00	0.01	1.60
Min	1,000.00	14.00	15.00	5.00	0.01	1.10
Max	8,200.00	65.00	68.00	12.00	0.04	24.30
Mean	3,166.67	25.67	33.00	7.50	0.01	12.20
SD	2,850.03	19.52	20.17	2.66	0.01	11.74
Baseline	4.72	95.00	850.00	45.00	0.40	-

Element	Sampling Area A		Sampling Area B	
	I_{geo} Value	Contamination Level	I_{geo} Value	Contamination Level
Fe	-1.3	Unpolluted	-4.94	Unpolluted
Zn	-0.74	Unpolluted	-2.71	Unpolluted
Mn	-3.95	Unpolluted	-5.49	Unpolluted

Cu	0.27	Moderately to strongly polluted	-3.24	Unpolluted
Hg	-2.53	Unpolluted	-5.57	Unpolluted

	Sampling area A	Sampling area B
C_f Fe	0.61	0.07
C_f Zn	0.96	0.27
C_f Mn	0.11	0.04
C_f Cu	0.95	0.17
C_f Hg	0.26	0.04
Cd	2.89	0.58
mCd	0.48	0.1
PLI	0.42	0.07

	Fe	Zn	Mn	Cu	Hg	χ_{lf}
Sampling area A						
Fe	1					
Zn	-0.163	1				
Mn	-0.029	**0.77**	1			
Cu	0.114	0.03	**0.656**	1		
Hg	-0.145	**0.6**	**0.658**	0.239	1	
χ_{lf}	-0.831	**0.555**	0.392	-0.025	0.49	1
Sampling area B						
Fe	1					
Zn	-0.5	1				
Mn	**0.965**	-0.541	1			
Cu	**0.977**	-0.573	**0.964**	1		
Hg	-0.286	-0.117	-0.243	-0.092	1	
χ_{lf}	-0.586	**0.595**	-0.431	-0.506	0.367	1

]

List of Figures

Fig. 1. The sampling site of agriculture soil from vegetable production center in Banjarbaru Region

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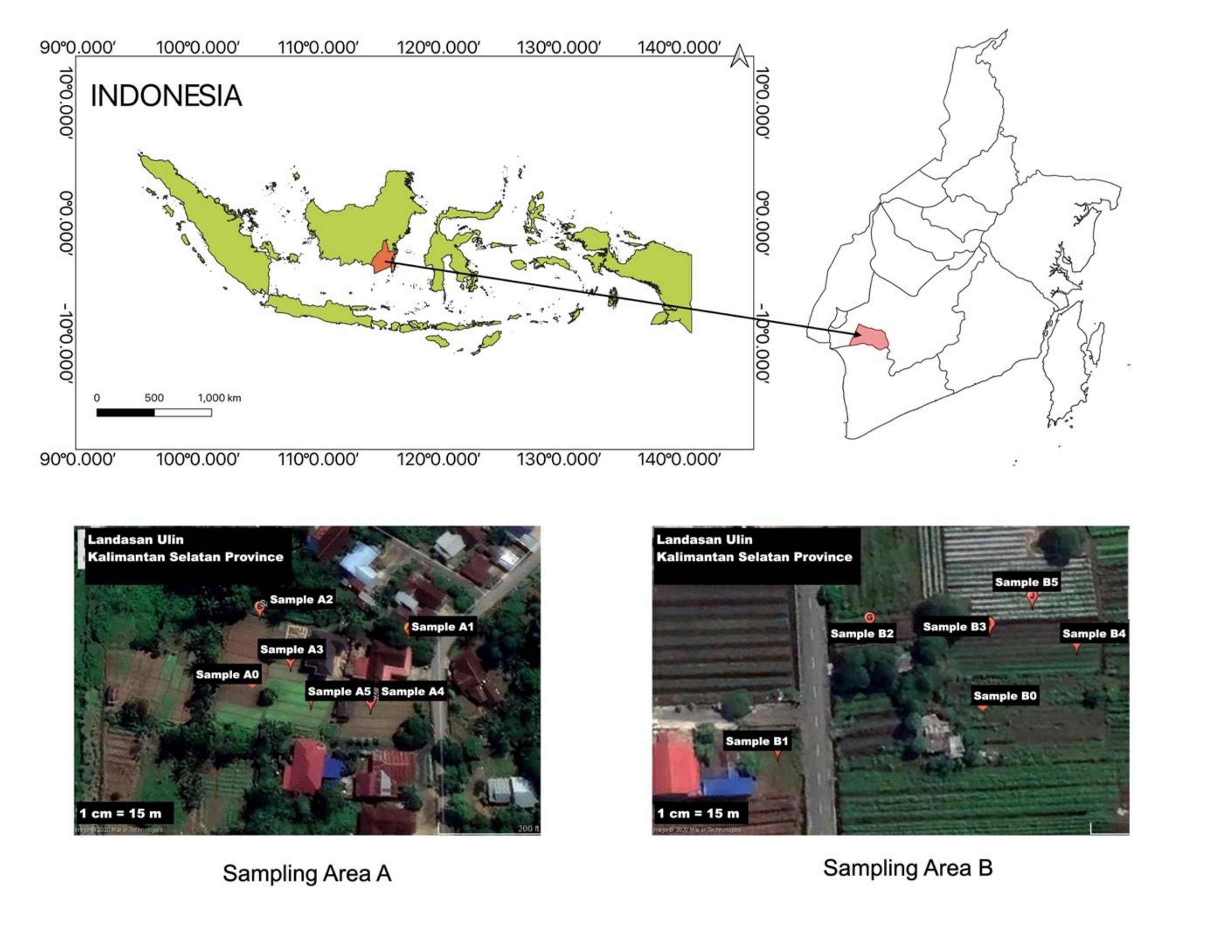
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Sample A1
Sample A2
Sample A3
Sample A4
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Landasan Ulin
Kalimantan Selatan Province
Sample B0
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Sample B3
Sample B4
Sample B5
1 cm = 15 m
Sampling Area B

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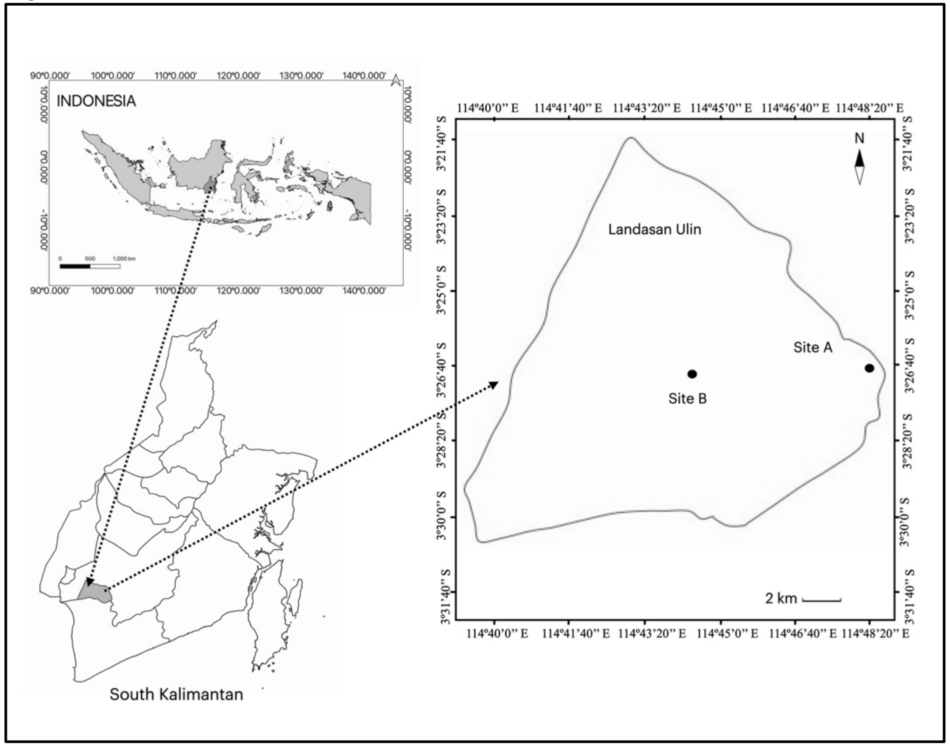
SECOND REVISION

Author's Respond Form

Manuscript ID	PJOES-00324-2022-01
Title	Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia
Authors	Sudarningsih Sudarningsih *, Fahruddin Fahruddin, Muhammad Lailiyanto, Alif Antasari Noer, Sadang Husain, Simon Sadok Siregar, Sri Cahyo Wahyono, Ichsan Ridwan
Submission date	05 March 2022
Revision date	26 May 2022
Reviewer	**2**

Editor's Evaluation	Details of Author's Respond	Modification
Editor's Comments	**Author's Respond**	
R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way	This has been revised accordingly	
In references all authors name must be included	This has been revised accordingly	
E-mail address of Corresponding Author must be provided	This has been revised accordingly	
Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References	This has been revised accordingly	
Answers to all the Reviewer comments	This has been revised accordingly	

Reviewers' Evaluation	Details of Author's Respond	Modification
Reviewer-1 Comments	**Author's Respond**	
Authors used only 12 samples which clearly is not statically significant. Some justification should be given on this.	This has been revised accordingly	See lines 105-108: Twelve agriculture soil samples were taken from two different area (Site A and site B) (Fig.1). Site A in Dahor Formation and site B in alluvial soil [20]. In general, agricultural soils in these two areas tend to be homogeneous with the chemical composition of the soil having low variability [19].

Reviewers' Evaluation	Details of Author's Respond	Modification
Reviewer-2 Comments	**Author's Respond**	
The manuscript should be corrected by removing unnecessary repetitions of data (the same data in Tables and in Figures) and detailed description of sites and sampling points should be added.	This has been revised accordingly	
Summary, line 26 - why Zn is two times	This has been revised accordingly	See line 26: The average concentration of heavy metals in the sampling area A is Fe>Zn>Mn>Cu>Hg, and the area B is Fe>Mn>Zn>Cu>Hg.
Map with locations of sampling points needed	We have added map with locations of sampling points.	See line 482: Figure 1:  Figure 1. The sampling site of agriculture soil from vegetable production center in Banjarbaru Region.

<table>
<tr>
<td>In how many repetitions analyses were conducted?</td>
<td>This has been revised accordingly</td>
<td>We have removed the figures.</td>
</tr>
<tr>
<td>Line 107- Why division into site A and B was performed – what was the difference between thes two sites? Again map with marked Site A and B needed. Pleaese explain shortly this Rahman's method</td>
<td>This has been revised accordingly</td>
<td>See line 482:
Figure 1. The sampling site of agriculture soil from vegetable production center in Banjarbaru Region.

See line 108-113:
These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21].</td>
</tr>
<tr>
<td>Table 1. – the same number of decimals should be maintained.</td>
<td>This has been revised accordingly</td>
<td>See line 418:
Table 1:
<table>
<tr><th rowspan="2">Sample</th><th>Fe</th><th>Zn</th><th>Mn</th><th>Cu</th><th>Hg</th><th rowspan="2">χ_{lf} (× 10^{-8} m^3kg^{-1})</th></tr>
<tr><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th><th>(mg/kg)</th></tr>
<tr><td colspan="7">Sampling Area A</td></tr>
<tr><td>A0</td><td>28,600.00</td><td>156.00</td><td>112.00</td><td>49.00</td><td>0.12</td><td>136.50</td></tr>
<tr><td>A1</td><td>28,100.00</td><td>124.00</td><td>161.00</td><td>147.00</td><td>0.12</td><td>135.60</td></tr>
<tr><td>A2</td><td>27,300.00</td><td>77.00</td><td>60.00</td><td>70.00</td><td>0.08</td><td>100.10</td></tr>
<tr><td>A3</td><td>26,900.00</td><td>57.00</td><td>52.00</td><td>70.00</td><td>0.11</td><td>135.60</td></tr>
<tr><td>A4</td><td>31,800.00</td><td>65.00</td><td>70.00</td><td>89.00</td><td>0.09</td><td>47.30</td></tr>
<tr><td>A5</td><td>30,400.00</td><td>71.00</td><td>81.00</td><td>91.00</td><td>0.11</td><td>44.80</td></tr>
<tr><td>Min</td><td>26,900.00</td><td>57.00</td><td>52.00</td><td>49.00</td><td>0.08</td><td>44.80</td></tr>
<tr><td>Max</td><td>31,800.00</td><td>156.00</td><td>161.00</td><td>147.00</td><td>0.12</td><td>136.50</td></tr>
<tr><td>Mean</td><td>28,850.00</td><td>91.67</td><td>89.33</td><td>86.00</td><td>0.10</td><td>100.00</td></tr>
<tr><td>SD</td><td>1,893.94</td><td>39.00</td><td>41.00</td><td>34.00</td><td>0.01</td><td>44.03</td></tr>
<tr><td colspan="7">Sampling Area B</td></tr>
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<tr><td></td><td></td><td>
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<tr><td>B0</td><td>2,500.00</td><td>20.00</td><td>38.00</td><td>7.00</td><td>0.01</td><td>23.30</td></tr>
<tr><td>B1</td><td>1,500.00</td><td>21.00</td><td>23.00</td><td>7.00</td><td>0.04</td><td>21.00</td></tr>
<tr><td>B2</td><td>1,000.00</td><td>65.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>24.30</td></tr>
<tr><td>B3</td><td>8,200.00</td><td>14.00</td><td>68.00</td><td>12.00</td><td>0.01</td><td>1.10</td></tr>
<tr><td>B4</td><td>4,800.00</td><td>14.00</td><td>39.00</td><td>9.00</td><td>0.01</td><td>1.90</td></tr>
<tr><td>B5</td><td>1,000.00</td><td>20.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>1.60</td></tr>
<tr><td>Min</td><td>1,000.00</td><td>14.00</td><td>15.00</td><td>5.00</td><td>0.01</td><td>1.10</td></tr>
<tr><td>Max</td><td>8,200.00</td><td>65.00</td><td>68.00</td><td>12.00</td><td>0.04</td><td>24.30</td></tr>
<tr><td>Mean</td><td>3,166.67</td><td>25.67</td><td>33.00</td><td>7.50</td><td>0.01</td><td>12.20</td></tr>
<tr><td>SD</td><td>2,850.03</td><td>19.52</td><td>20.17</td><td>2.66</td><td>0.01</td><td>11.74</td></tr>
<tr><td>Baseline</td><td>4.72</td><td>95.00</td><td>850.00</td><td>45.00</td><td>0.40</td><td>-</td></tr>
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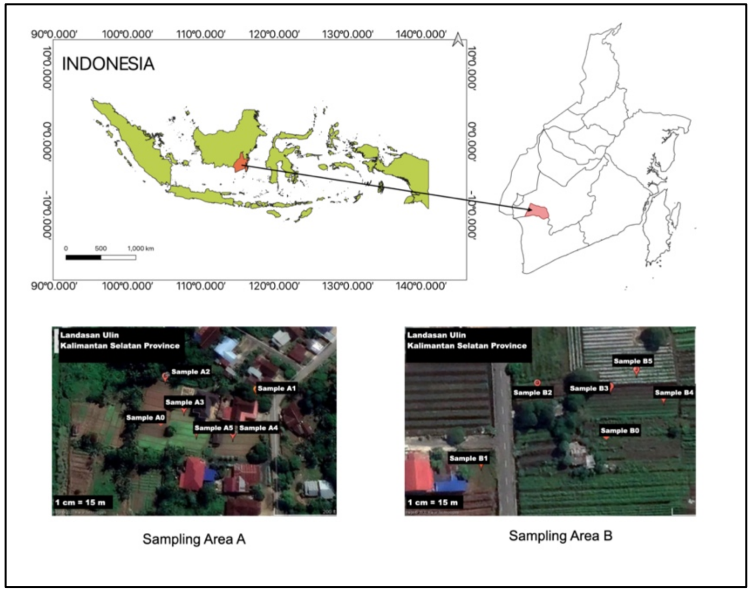
</td></tr>
<tr><td>Figures 1 – 3 – These are the same data as in Table 1, remove these Figures – they are incorrect, as far as I understand there isn’t any connection between f.ex. point „0” in Site A and B, so it is inappropriate to show them as one bar.</td><td>We have removed the figures.</td><td></td></tr>
<tr><td>What is the difference between Table 2 and Figure 4? They both show Igeo but the results are different. And again this is unnecessary repetitions.</td><td>We have removed Figure 4.</td><td></td></tr>
<tr><td>I suggest to expand description of both sites and sampling points and try to explain where such big differences in specific locations come from (f.ex. in site A1).</td><td>This has been revised accordingly</td><td>See line 181-185:
At site A, the content of Mn and Cu at point A1 is higher than at other points which are suspected come from fertilizers and pesticides [36], also from traffic waste [28, 29], as well as Zn. This is known based on the location of point A1 which is closest to the highway. In addition, the high content of Mn at point A1 is thought to also originate from the post-harvest processing of agricultural land [38].</td></tr>
<tr><td>Description of the way of taking samples is needed.</td><td>This has been revised accordingly</td><td>See line 108-113:
These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21].</td></tr>
</table>

Author's Respond Form

Manuscript ID	PJOES-00324-2022-01
Title	Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia
Authors	Sudarningsih Sudarningsih *, Fahruddin Fahruddin, Muhammad Lailiyanto, Alif Antasari Noer, Sadang Husain, Simon Sadok Siregar, Sri Cahyo Wahyono, Ichsan Ridwan
Submission date	05 March 2022
Revision date	2 August 2022
Reviewer	

Editor's Evaluation	Details of Author's Respond	Modification
Editor's Comments	**Author's Respond**	
R e f e r e n c e s should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article according to Journal way	This has been revised accordingly	
In references all authors name must be included	This has been revised accordingly	
E-mail address of Corresponding Author must be provided	This has been revised accordingly	
Manuscript should be divided into the sections: Abstract, Keywords, Introduction, Material and Methods (could be omitted in Reviews), Results and Discussion, Conclusions, Acknowledgements, References	This has been revised accordingly	
Answers to all the Reviewer comments	This has been revised accordingly	

Reviewers' Evaluation	Details of Author's Respond	Modification
Reviewer Comments	**Author's Respond**	
In how many repetitions analyses were conducted?	This has been revised accordingly	See lines 132-133 For susceptibility magnetic analyses, each sample was measured with three repetitions. The magnetic susceptibility value used is the average value of the results of this measurement [13]. See lines 134-139 To analyze the level of heavy metal pollution in an area, more than one pollution index analysis is needed (3, 21, 36, 37), so in this study 5 pollution indices were used, namely the geoaccumulation index (Igeo), contamination factor (Cfi), the

		degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI). The five pollution indices are expected to provide more accurate information on the level of pollution in this research area.
Why division into site A and B was performed	This has been revised accordingly	See lines 110-113 In general, agricultural soils in these two areas tend to be homogeneous, with the chemical composition of the soil having low variability [19]. But geologically, these two areas are in two different formations. Site A is in the Dahor Formation and Site B is in alluvial soil [20]. That is why this research is divided into two different research areas.
Also the manuscript would be more valuable if the analyses comprised more samples - in this form it has only local meaning	This has been revised accordingly	This research is a local research, because the samples used in this study were collected before the flood in the research area, so it is no longer possible to increase the number of samples with the same conditions as before the flood.
English language needs revision	This has been revised accordingly	
Figures : Not acceptable	This has been revised accordingly	See lines 431 

Pol. J. Environ. Stud. Vol. X, No. X (2016),

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Type of the Paper (Article, Review, Short Communication.)

Assessment of Soil Contamination by Heavy Metals: A Case of Vegetable Production Center in Banjarbaru Region, Indonesia

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Received:

Accepted:

Abstract:

Landasan Ulin is a center for vegetable production, and it has an important role in producing vegetables for the city of Banjarbaru. Agricultural soil in this study was assessed for heavy metal contamination using the geoaccumulation index (Igeo), contamination factor (C_f^i), the degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI) as well as magnetic susceptibility. Samples were collected from topsoil and analyzed using magnetic susceptibility and Atomic Absorption Spectrophotometer (AAS). The average concentration of heavy metals in the sampling area A is Fe>Zn>Mn>Cu>Hg, and the area B is Fe>Mn>Zn>Cu>Hg. Magnetic susceptibility values in area A is higher than in area B and the value of magnetic susceptibility can be used as a proxy for monitoring heavy metal concentrations, especially Zn in this area. Zn and Cu exceeded the threshold set by the Indonesian Standards Institute. Igeo results show that the research area is moderately contaminated with Cu, Zn, and Hg. According to C_f^i, the soil was classified as low contaminated with Fe, Zn, Cu, Mn, and Hg, as well as Cd and mCd. The PLI results show that in both area, drastic corrective action is not required.

Keywords: geoaccumulation index; contamination factor; contamination degree; pollution load index

Introduction

Heavy metal contamination of agricultural soil due to chemical fertilizers and pesticides is a serious ecological problem today [1, 2]. In agricultural soil, the continuous use of manure and chemical fertilizers for a long time will result in higher heavy metal content [3, 4]. Some heavy metals are needed for the growth of certain plants [5], but some of them for humans can be toxic. When these heavy metals are absorbed and accumulated by plants and then consumed by humans, this will pose a risk to the human body [6].

Some heavy metals have been found in agricultural land in several areas in Indonesia, such as Pb found in soil from 168 locations with different land use and traffic conditions in Yogyakarta, Indonesia [7]. In Semarang, Indonesia, the paddy field contains heavy metals Pb, Cd, and Cu [8]. In agricultural land in Karawang, Pb and Cd were found with concentrations exceeding 1.0 ppm [9]. Meanwhile, in agricultural soils in Bangladesh for the dry season, heavy metals were found with concentrations of As>Fe>Hg>Mn>Zn>Cu>Cr>Ni>Pb>Cd and in the rainy season As>Fe>Mn>Zn>Hg>Cu>Ni>Cr>Pb>Cd [10]. In paddy soils at Hunan Province, China, there was founded heavy metals (Cd, Cr, As, Ni, Mn, Pb, and Hg) in three different locations [11].

The presence of magnetic minerals in the soil can come from weathering of the parent rock (lithogenic origin) and can also come from human activities (anthropogenic). Magnetic minerals that are commonly found in soil are hematite and magnetite. Their presence is in the form of solid waste which can act as the main absorber of pollutants such as heavy metals in the soil. Their presence in the soil will affect the value of the magnetic susceptibility of the soil. The use of magnetic susceptibility has been widely used in various soil science studies, such as soil morphology and genesis as well as tools for mapping the distribution of environmental pollutants [12]. Magnetic susceptibility measurement has been considered as a fast and cheapest monitoring tool for determining the spatial distribution of heavy metal presence in soil and can be used as a proxy for chemical methods [13]. Research using the method of environmental magnetism in Indonesia is still few in number. Several studies were conducted to examine the river and lake environment [14–17] Therefore, this study is very important.

Landasan Ulin is a vegetable center production in Banjarbaru City, South Kalimantan, Indonesia. Agricultural activities in this area are carried out by farmers traditionally [18]. Meanwhile, agricultural land has the potential to experience heavy metal pollution, and studies on heavy metal pollution in agriculture in this area are still rarely carried out. Therefore, it is very important to conduct this research to determine the current status of the presence of these heavy metals on the surface of agricultural soil. This will be of benefit to ameliorate the impacted environmental problems further, and to adopt mitigation strategies in the future. This study aims to investigate the level of contamination of various heavy metals (Fe, Mn, Cu, Zn, Hg) in agricultural land located in Landasan Ulin, South Kalimantan, Indonesia, using different indices such as geoaccumulation index, pollution factor, degree of pollution, and the pollution load index. The correlation between heavy metal contamination and magnetic susceptibility is also investigated in this study. These results can be used as an alternative method in determining heavy metal contamination in agricultural areas. This approach will help monitor the presence of heavy metals in agricultural soils and soil remediation. Monitoring for polluted areas is crucial, and it is beneficial for the sustainability of pollution management and control in the future.

Materials and Methods

Study Area

Sampling and Measurements

Index of Geoaccumulation, Contamination Factor (C_f^i), Degree of Contamination (Cd) and Pollution Load Index (PLI)

Landasan Ulin, South Kalimantan Province, Indonesia, has a 92.42 km2 area, consisting of mountains and hills in the north and east, and lowlands to the west, while the south has alluvium and swamp areas. Landasan Ulin is about 40 km from the provincial capital, Banjarmasin. Landasan Ulin is a vegetable production area in South Kalimantan. The cultivated vegetables from the area include mustard greens, kale, spinach, eggplant, lettuce, long beans, peanuts, and scallions. One of the efforts to increase the yield and quality of vegetables is through fertilization. Both organic and inorganic fertilizers are applied. The used dose of organic fertilizer was 485 kg, or an average of 16.17 kg/farmer, while the inorganic fertilizer was 556 kg, or an average of 18.53 kg/farmer. Nitrogen (N) fertilizer is critical for the growth of vegetables. The crops are never separated from the disturbance of weeds and pests. Theoretically, weeds are bothering vegetable growth because they are competitive in many ways, especially in getting water, sunlight, and nutrients. Weeds also, in some cases, become the source of the disease that often becomes a significant threat to the corps. To manage the growth of weeds, farmers do the chemical control of weeds regularly by using Gramoxon. About 400 liters is enough to kill weeds on an average of 13.33 liters/respondent. Removing the weeds can also be done manually by using physical measures or machinery. Meanwhile, in overcoming pests and diseases in North Landasan Ulin Village, the farmers used Ampligo, one of the pesticide brands. It is sprayed regularly with a dose that ranges from 20 liters or an average of 0.67 liters/farmer to kill/destroy pests that stick around the leaves and stems of mustard greens [19].

Twelve agriculture soil samples were taken from two different area (Site A and site B) (Fig.1). In general, agricultural soils in these two areas tend to be homogeneous, with the chemical composition of the soil having low variability [19]. But geologically, these two areas are in two different formations. Site A is in the Dahor Formation and Site B is in alluvial soil [20]. That is why this research is divided into two different research areas. These samples were collected using the sampling procedure based on Rahman's methods. Approximately 250–300 g of agricultural soil were collected from the soil surface layer (15–20 cm) using a stainless steel grab sampler. The difference in distance from one sampling point to another in one location is about 100 m. The sample taken is in the center to avoid contact with the inside of the grab sampler material. Samples are checked for possible contamination. Then the sample was transferred to a previously cleaned plastic container [21]. In the laboratory, the soil sample was dried by aerating at room temperature. The dry soil samples were sieved using a 325 mesh-size sieve (44 µm in diameter) to obtain homogeneous soil particles. 2–3 g dry soil samples were digested in about 15 mL of aqua-regia (HCL: HNO3 = 3:1) for about 4–5 hours on a hotplate set to 110 °C. The materials were then diluted to 50 mL in a 100 mL Pyrex glass beaker with distilled water. In the laboratory of the Indonesian Geological Survey in Bandung, Indonesia, by AA280FS Atomic Absorption Spectrometer (AAS) (Variant Inc. Palo Alto, USA), the solution was filtered, and the filtrates were examined. The working standard solutions for each metal were prepared before every analysis. An air acetylene flame AAS was used to measure Fe, Zn, Cu, Pb, and Mn concentrations, with As determined by hydride vapor generation AAS. Magnetic susceptibility measurement was carried out in the following way, the dried soil sample was put into a cylindrical plastic holder with a diameter of 25.4 mm and a height of 22 then measured using a Susceptibilitymeter (Bartington Instrument Ltd., Oxford, UK). Each sample was measured with three repetitions. The magnetic susceptibility value used is the average value of the results of this measurement [13].

To analyze the level of heavy metal pollution in an area, more than one pollution index analysis is needed (3, 21, 36, 37), so in this study 5 pollution indices were used, namely the geoaccumulation index (I_{geo}), contamination factor (C_{fi}), the degree of contamination (Cd), the degree of modified contamination (mCd), and the Pollution Load Index (PLI). The five pollution indices are expected to provide more accurate information on the level of pollution in this research area.

Müller's geoaccumulation index (Igeo) [22], which was originally established to measure contamination of sedimentary bottoms, may now be used to assess soil contamination. It's calculated using equation (1) as follows:

$$I_{geo} = \log_2 \frac{C_n}{1.5B_n} \quad (1)$$

Cn is the element's observed concentration in the pelitic sedimentary fraction (<2 m), and Bn is the geochemical background value based on argillaceous sedimentary fossils (shale mean). C_f^i and C_d are indices that can be used to assess soil contamination which consists of four classes [23]. Equation (2) was utilized in the following way:

$$C_f^i = \frac{C_0^i}{C_n^i} \quad (2)$$

C_0^i is the pre-industrial concentration of the specific metal, and C_n^i is the mean content of metals from at least five sampling sites. As a result, the computed C_d is defined as the amount of C_f^i determined by Hakanson for the polluting species [23]. The following is the equation used to calculate C_d

$$C_d = \sum_{i=1}^{n} C_f^i \quad (3)$$

C_d is intended to measure the overall level of contamination in the surface layer at a particular sampling site. In this study, we applied a factor modification as applied by Krzysztof [24]. Abrahim [25] proposes the following modified and generalized version of the Hakanson equation [23] for estimating the total degree of contamination at a sample or coring location. Equation 4 is a modified equation for the general approach to calculating contamination levels.

$$mC_d = \frac{\sum_{i=1}^{i=n} C_f^i}{n} \quad (4)$$

Where n denotes the number of elements to be examined and the contamination factor is abbreviated as C_f^i. Using this formula to compute mC_d allows metals to be incorporated into studies with no upper limit. To identify pollution, Tomlinson created the pollutant load index (PLI) [26]. This index allows for comparisons of pollution levels between sites and across time. The PLI was calculated as a concentration factor for each heavy metal in relation to the soil background value. The background for the heavy metal in this investigation was the average world concentration of the examined metal reported for shale [27]. PLI can assess the level of metal contamination and the actions that must be taken. The formulas used are in the form of equations (5).

$$PLI = n\sqrt{C_{f1} \times C_{f2} \times \ldots \times C_{fn}} \quad (5)$$

Results and Discussion

Heavy metal Content and Magnetic susceptibility

Soil Pollution Degree

Correlation Between Heavy Metal Content and Magnetic Susceptibility

Table 1 shows the average concentrations of a number of metals in the agricultural soils of the study area. The average Fe, Zn, Mn, Cu, and Hg concentrations in study area A were 28,850.00, 91.67, 89.33, 86.00, and 0.10 mg/kg. The average amounts of Fe, Zn, Mn, Cu, and Hg in B were 3,166.00, 25.67, 33.00, 7.50, and 0.01 mg/kg, respectively. Metal trends in research area A are Fe>Zn>Mn>Cu>Hg. Meanwhile, the trends of metals according to the average concentration in study area B is: Fe>Mn>Zn>Cu>Hg. Due to the agronomic practice, the concentration of heavy metals in study area B was various. Meanwhile, metal concentration trends in study area B are as follows: Fe>Mn>Zn>Cu>Hg. The concentration of heavy metals in study area B varied due to agronomic practices. The low heavy metal concentration in the soil can be attributed to the constant elimination of heavy metals by vegetables grown in the designated regions [21]. Table 1 also includes the magnetic susceptibility values of the samples from areas A and B. In general, the magnetic susceptibility values of area A (100.0×10^{-8} m^3kg^{-1}) were 9 times greater than those of area B (12.2×10^{-8} m^3kg^{-1}). Magnetic susceptibility of sampling area A ranges from 44.8 to 136.5×10^{-8} m^3kg^{-1}, while magnetic susceptibility of sampling area B ranges from 1.1 to 24.3×10^{-8} m^3kg^{-1}. Agricultural practices, such as the use of magnetic minerals such as Fe in fertilizers and pesticides, can increase the magnetic mineral content of agricultural soil. Magnetic minerals in agricultural soil can also be found in household waste. As is well known, the research site, area A, is located very close to settlements, whereas area B is located far from settlements. Household waste contains anthropogenic magnetic minerals, which can raise the magnetic susceptibility value [28].

The content of Mn and Cu at point A1 in area A is higher than at other points, which are suspected to be from fertilizers and pesticides [36], as well as traffic waste [28, 29] and Zn. This is known because of the proximity of point A1 to the highway. Furthermore, the high Mn content at point A1 is thought to be the result of post-harvest processing of agricultural land [38].

The average Igeo and contamination levels of several metals in soil are shown in Table 2. Igeo is highly variable, implying that the soil surrounding the sampling area was uncontaminated to moderately contaminated in terms of the metals tested. The average concentration of heavy metals was higher in study area A than in site B. Long-term use of machine tools, paints, pigments, and industrial equipment in the study area may have caused the highest Fe content in the soil [10]. The average concentration of Zn, Mn, Cu, and Hg found in study area A was also higher than in study area B. The presence of heavy metals in this area was suspected due to agricultural practices. Pesticides contain the elements Mn, Zn, and Cu (Cu, As, Hg, Pb, Mn, and Zn). Fungicides contain the elements Cu, Zn, and Mn. Compost and manure also contain Zn and Cu. Seed dressings contain Hg [30-32].

Zn is present in all sampling points at study area A, but not all sampling points at location B. Zn concentrations were approximately three times higher in sampling points at site A than in sampling points at site B. The average Zn concentration at sites A and B exceeded the 0.06 mg/kg threshold set by the Indonesian National Standardization Agency. However, the Zn concentration at these two sites was still low when compared to agricultural soils in Shenzhen, China (concentration average of 194 mg/kg in the dry season and 209 mg/kg in the rainy season) [33], soil in an unpolluted area of Gebze, China (concentration average 632 mg/kg) [34], and agricultural soil from Huanghuai Plain, China (74 mg/kg) [35]. In contrast to Zn, Cu was distributed over all sampling points in both study locations, and the concentration in site A was ten times higher than in site B.

The average Cu concentration in both locations also exceeded the 0.04 mg/kg threshold set by the Indonesian National Standardization Agency. However, the concentration of Cu at these two locations was still low when compared to agricultural soils in Shenzhen, China (with an average of 60 mg/kg in the rainy season and 90 mg/kg in the dry season) [33], as well as soils in unpolluted areas in Gebze, China (concentration average 95.88 mg/kg) [34], palm farms' soil in Morocco (concentration average 138 mg/kg) [36], and agricultural soil from Patuakhali District, Bangladesh (4.1–181 mg/kg) [37]. However, the Cu content at Site A was higher than the Cu content in agricultural soils in the Dumuria Upazila, Bangladesh [38] and Marrakech, Morocco [39] areas, whereas the Cu content at Site B was lower than the Cu content in agricultural soils in the Dumuria Upazila, Bangladesh (concentration average 17.70 mg/kg) and Marrakech, Morocco. Cu concentrations are higher in these two locations than in agricultural soils from Jeddah, Arab Saudi Arabia (concentration average 0.4 mg/kg) [40].

Hg concentrations were four times higher in site A than in site B. The presence of Hg was suspected to be the result of fungicide use. Hg in soil can be produced by a number of activities, including basic metal processing, some chemical sector activities, mining, and industrial waste. Hg concentrations in Gebze soil ranged from 9 to 2.721 g/kg, with an average of 102 g/kg [34], which is significantly higher than the concentrations found in this study. The Hg content of agricultural soils in China's Gorges Dam area is similar to that of this study area (0.08 mg/kg) [41]. Hg levels in sites A and B did not exceed the 0.5 mg/kg threshold for its presence in soil. According to this research, the concentration of heavy metals in site A is higher than in site B. According to observations and interviews with local farmers, site A was used for plantation activities much earlier than site B. Heavy metals accumulate in the soil over time due to a variety of factors, including the use of fertilizers, pesticides, and agricultural equipment [42, 43].

C_f was used to determine the overall contamination of the analyzed agricultural soil. The soil was classified as having a low contamination factor in both test regions, indicating low contamination with Fe, Zn, Mn, Cu, and Hg. The maximum contamination degree (C_d) values indicated a low level of contamination. As proposed in this work, the mC_d is calculated by combining and averaging all available analytical data for a collection of soil samples.

As a result, this improved method may provide a thorough assessment of the overall enrichment and contamination impact of various pollutant groups in the soil. In both sampling areas, the mC_d ranged from 0.48 to 0.10, indicating nil to a very low level of contamination. The PLI values indicated that drastic rectification measures are not needed in both areas. Table 3 shows the soil's average C_f^i, C_d, mC_d and PLI.

Pearson correlation analysis [44] was used to compare all of the variables. Table 4 displays the correlation coefficients between metal pairs. High correlation values (R>0.50) between different metal pairs, indicating soil accumulation. In soil samples from sampling area A, Mn-Zn (R=0.770), Cu-Mn (R=0.656), Hg-Zn (R=0.600), and Hg-Mn (R=0.600) had high correlation values (R> 0.5). The correlation trends in sampling area B were: Fe-Mn (R=0.965), Fe-Cu (R=0.977), and Cu-Mn (R=0.964).

Significant correlations indicate that they are thought to be anthropogenic, originating in agricultural activities such as the use of fertilizers and pesticides. Both of these areas are about 2 kilometers from Syamsuddin Noer airport, which is thought to contribute to heavy metal accumulation in the soil in this area [45]. Table 4 also shows the correlation coefficient between each heavy metal content and magnetic susceptibility measured in the same soil plane. According to the correlation analysis of each plot of land, several heavy metals show a positive correlation with magnetic susceptibility values, namely Zn (R=0.555), Mn (R=0.392), and Hg (R=0.490) in area A, and Zn (R=0.595) and Hg (R=0.367) in area B. When compared to other heavy metals, the content of the heavy metal Zn in both soil planes showed a stronger positive correlation coefficient with magnetic susceptibility. In both sampling areas, heavy metals such as Fe and Cu have negative correlation coefficient values with magnetic susceptibility.

Conclusions

In the biosphere, the soil is an essential component, every harmful change of it can seriously affect the quality of human life. It is very possible to have heavy metals content in the soil. Heavy metals that enter the food chain are the most detrimental because they can threaten human health. Some of the agricultural lands in Landasan Ulin, Banjarbaru, South Kalimantan are observed in this study. The lands were evaluated for the impact of anthropogenic heavy metals by using several indices that showed that study area A was not contaminated until moderately contaminated by different metals. Meanwhile, study area B did not show any contamination based on all indices. However, the presence of Cu and Zn in this region has exceeded the threshold set by the Indonesian National Standardization Agency, and this must be watched out for. For this reason, regular monitoring of heavy metals in agricultural land is necessary to ensure environmental quality. In addition, remediation measures need to be carried out on agricultural land indicated to be contaminated by Cu and Zn. This study also shows that magnetic susceptibility can be used as a proxy for monitoring the concentration of heavy metal especially Zn in agricultural soil in the Landasan Ulin area.

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Table 4. Pearson correlation (R) between heavy metal contents and magnetic susceptibility. The value of R for strong (above 0.5) correlation is in bold.

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Sample	**Fe (mg/kg)**	**Zn (mg/kg)**	**Mn (mg/kg)**	**Cu (mg/kg)**	**Hg (mg/kg)**	**χ_{lf} (× 10^{-8} m^3kg^{-1})**
Sampling Area A						
A0	28,600.00	156.00	112.00	49.00	0.12	136.50
A1	28,100.00	124.00	161.00	147.00	0.12	135.60
A2	27,300.00	77.00	60.00	70.00	0.08	100.10
A3	26,900.00	57.00	52.00	70.00	0.11	135.60
A4	31,800.00	65.00	70.00	89.00	0.09	47.30
A5	30,400.00	71.00	81.00	91.00	0.11	44.80
Min	26,900.00	57.00	52.00	49.00	0.08	44.80
Max	31,800.00	156.00	161.00	147.00	0.12	136.50
Mean	28,850.00	91.67	89.33	86.00	0.10	100.00
SD	1,893.94	39.00	41.00	34.00	0.01	44.03
Sampling Area B						
B0	2,500.00	20.00	38.00	7.00	0.01	23.30
B1	1,500.00	21.00	23.00	7.00	0.04	21.00
B2	1,000.00	65.00	15.00	5.00	0.01	24.30
B3	8,200.00	14.00	68.00	12.00	0.01	1.10
B4	4,800.00	14.00	39.00	9.00	0.01	1.90
B5	1,000.00	20.00	15.00	5.00	0.01	1.60
Min	1,000.00	14.00	15.00	5.00	0.01	1.10
Max	8,200.00	65.00	68.00	12.00	0.04	24.30
Mean	3,166.67	25.67	33.00	7.50	0.01	12.20
SD	2,850.03	19.52	20.17	2.66	0.01	11.74
Baseline	4.72	95.00	850.00	45.00	0.40	-

Element	Sampling Area A		Sampling Area B	
	I_{geo} Value	Contamination Level	I_{geo} Value	Contamination Level
Fe	-1.3	Unpolluted	-4.94	Unpolluted
Zn	-0.74	Unpolluted	-2.71	Unpolluted
Mn	-3.95	Unpolluted	-5.49	Unpolluted

Cu	0.27	Moderately to strongly polluted	-3.24	Unpolluted
Hg	-2.53	Unpolluted	-5.57	Unpolluted

	Sampling area A	Sampling area B
C_f Fe	0.61	0.07
C_f Zn	0.96	0.27
C_f Mn	0.11	0.04
C_f Cu	0.95	0.17
C_f Hg	0.26	0.04
Cd	2.89	0.58
mCd	0.48	0.1
PLI	0.42	0.07

	Fe	Zn	Mn	Cu	Hg	χ_{lf}
Sampling area A						
Fe	1					
Zn	-0.163	1				
Mn	-0.029	**0.77**	1			
Cu	0.114	0.03	**0.656**	1		
Hg	-0.145	**0.6**	**0.658**	0.239	1	
χ_{lf}	-0.831	**0.555**	0.392	-0.025	0.49	1
Sampling area B						
Fe	1					
Zn	-0.5	1				
Mn	**0.965**	-0.541	1			
Cu	**0.977**	-0.573	**0.964**	1		
Hg	-0.286	-0.117	-0.243	-0.092	1	
χ_{lf}	-0.586	**0.595**	-0.431	-0.506	0.367	1

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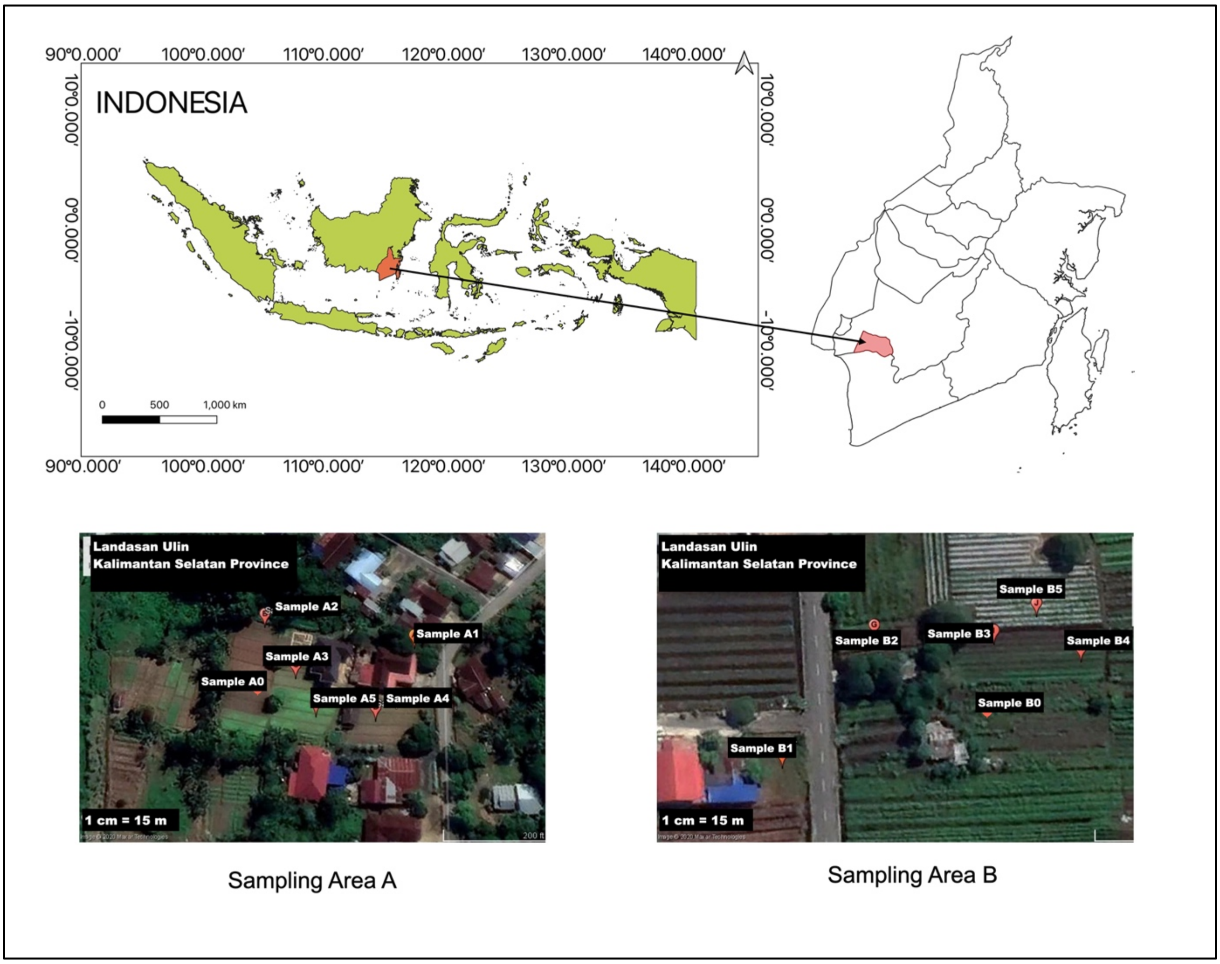
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Sample A4
Sample A5
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Sample B5
1 cm = 15 m
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Assessment of Soil Contamination by Heavy

Metals: A Case of Vegetable Production Center

in Banjarbaru Region, Indonesia

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