BRNO UNIVERSITY OF TECHNOLOGY
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Heavy Metal Fixation in Biochar after Microwave Pyrolysis of Sewage Sludge

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Outline:

1. Introduction: relevant legislation, MP technology, products;

2. Materials and Methods of MP: full-scale testing MP unit, samples of sewage sludge, chemistry experiments;

3. Results and discussion: heavy metal fixation;

4. Summarizing discussion: recapitulation;

5. Conclusion: current state of research.

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1. Introduction

- Disposal of the sewage sludge is one of the important issues in EU, CR of waste management;
- new legislation in CR, landfill ban and no direct agriculture application;
- parameters in focus: catalysts, microwave pyrolysis technology, dry solids, heavy metals fixation, surface and pores analysis;
- product of pyrolysis is: a charcoal (biochar) and pyrolysis oil and pyrolysis gas (Syngas);
- MP of SS leads to: carbon footprint reduction, heavy metal fixation and water retention.

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2. Materials and Methods of MP

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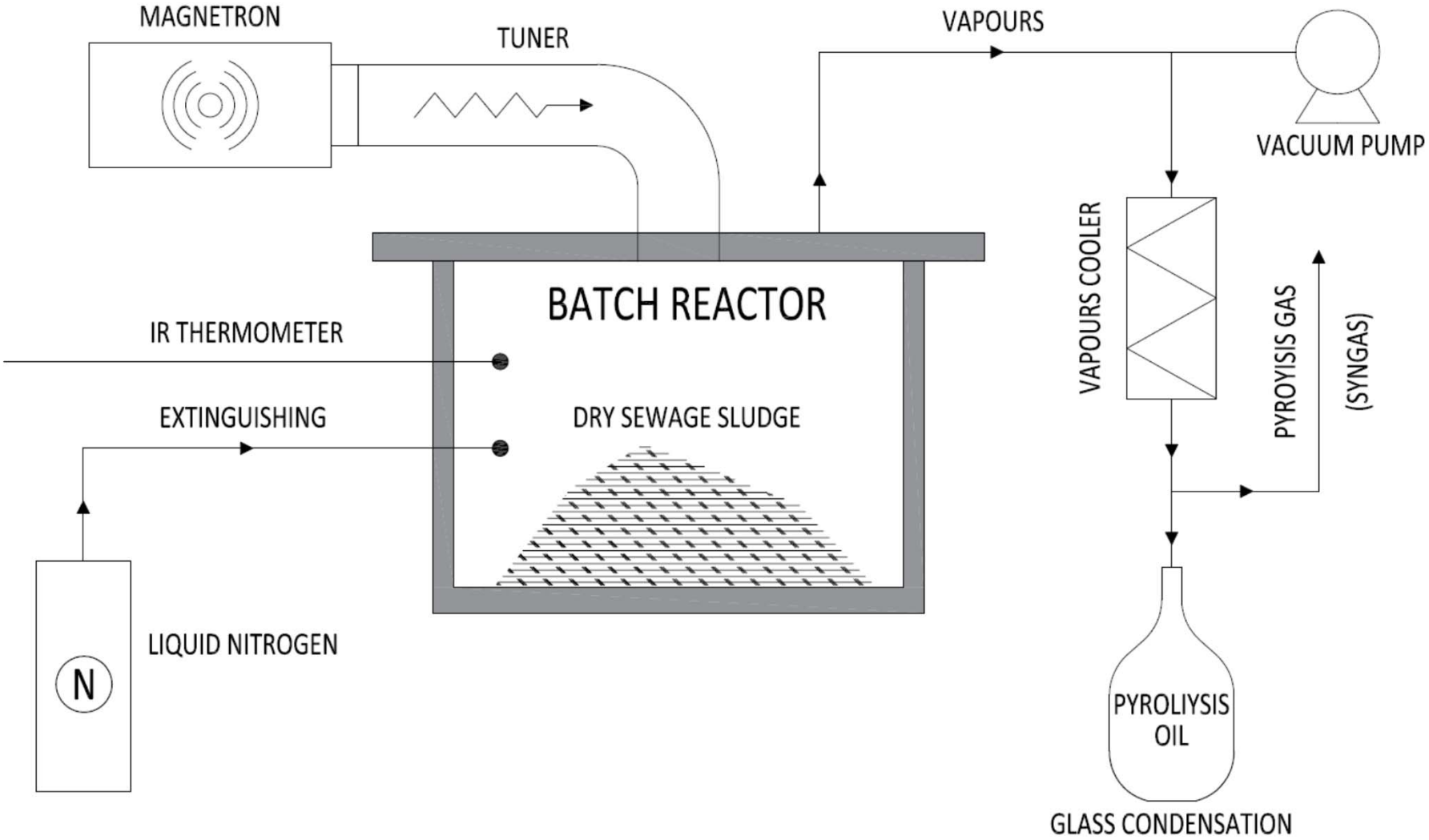
MAGNETRON
TUNER
VAPOURS
VACUUM PUMP
VAPOURS COOLER
PYROYISIS GAS
(SYNGAS)
BATCH REACTOR
IR THERMOMETER
EXTINGUISHING
DRY SEWAGE SLUDGE
N
LIQUID NITROGEN
PYROLIYSIS
OIL
GLASS CONDENSATION

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2. Materials and Methods of MP

- Tests for determination HM fixation:

1. with pelletization and with additive;
2. with pelletization and without additive;
3. without pelletization and without additive.

- Leachates tests:

a) the soluble HM were determined by analysis of water extracts = biologically available HM in SS and in BC (BAHM), hazardous for plants and organisms;

b) total HM content were determined after digestion of samples in *AquaRegia* = fixed HM in SS and in BC (HMFIX);

c) non-detected HM in BC after MP (transported by vapors to pyrolysis gas and oil).

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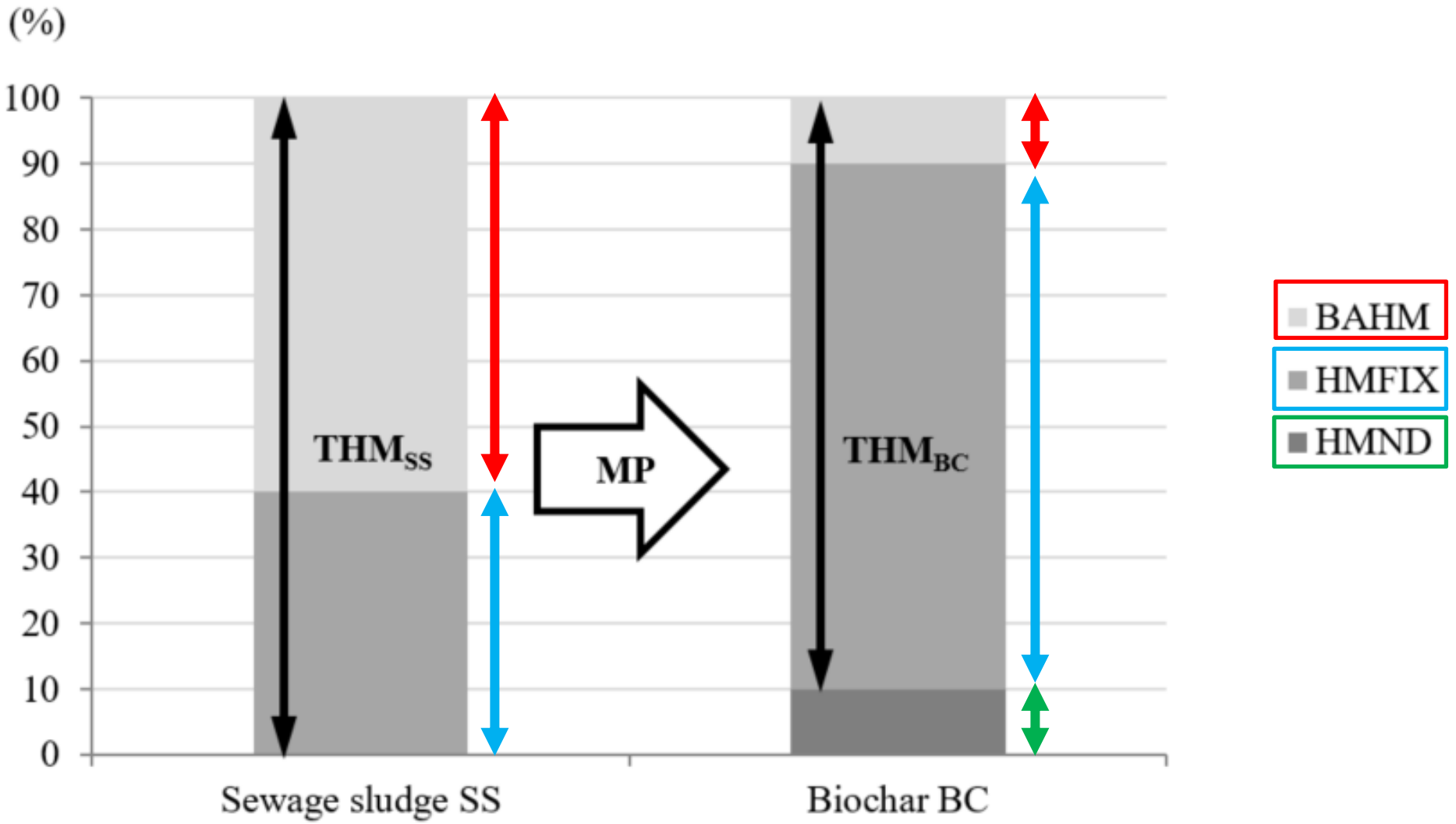
Transformation HM before (SS) and after MP process (BC)



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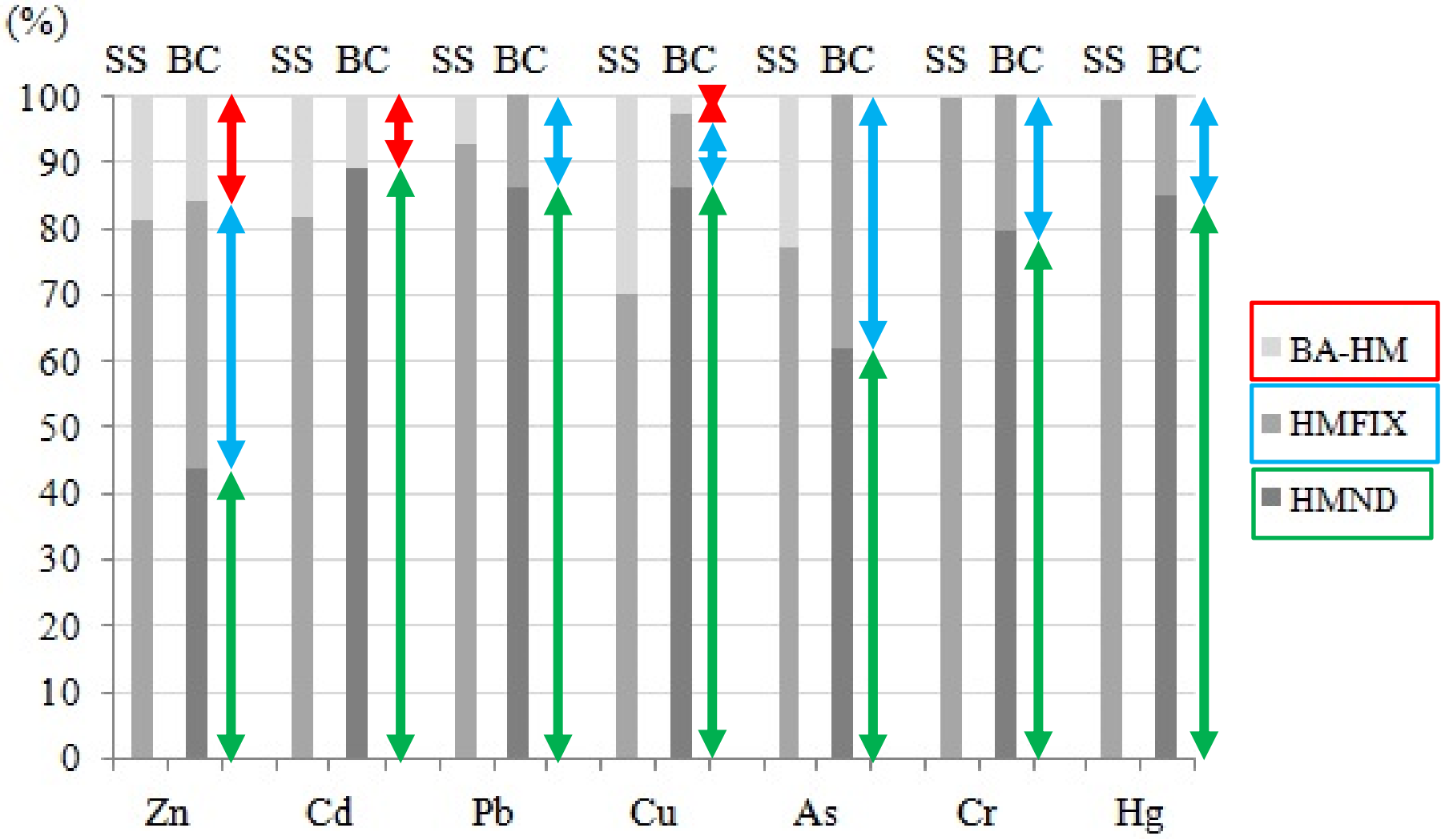
1. Weight of HM with pelletization and with additive



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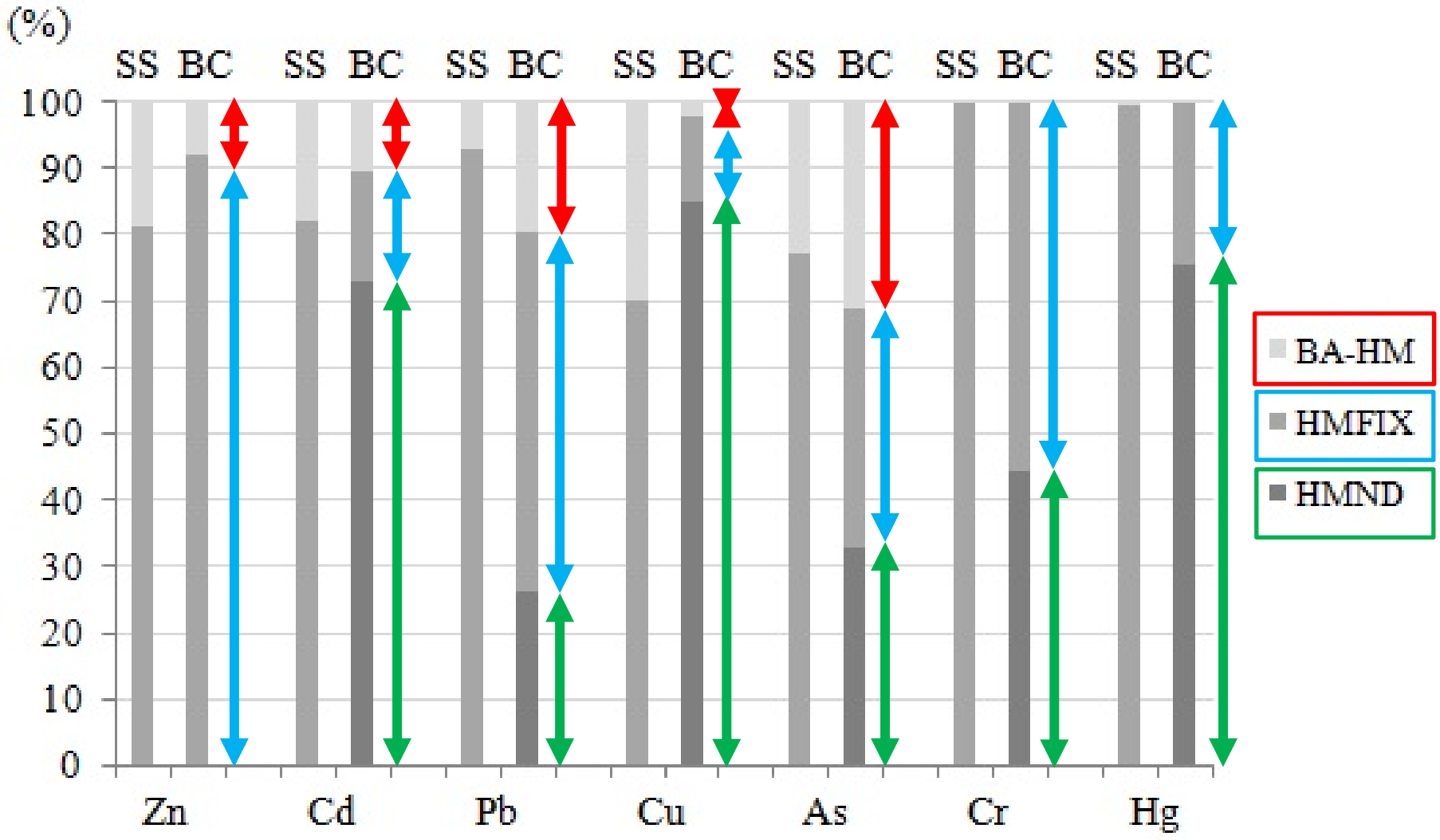
2. Weight of HM with pelletization and without additive



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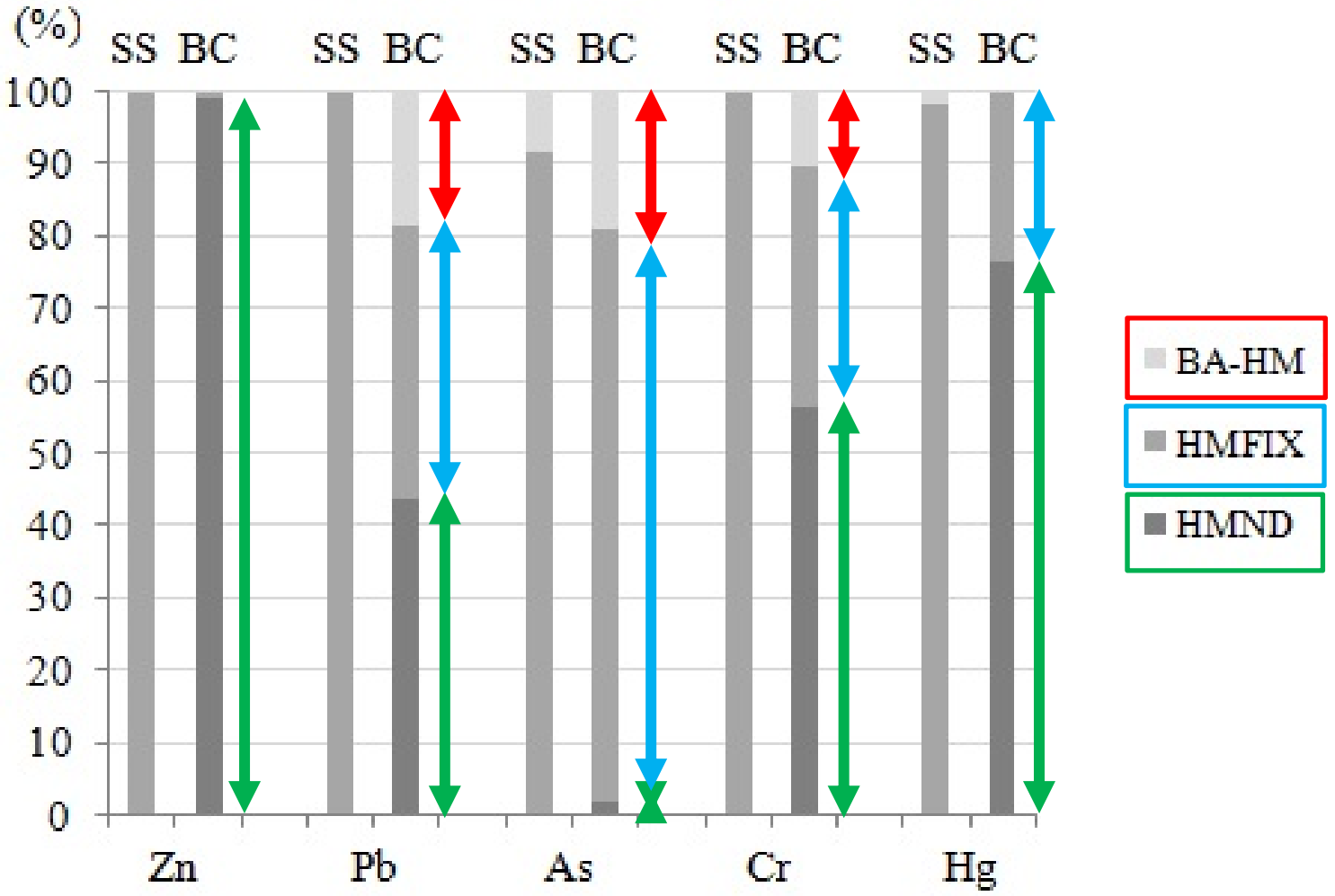
3. Weight of HM with pelletization and without additive



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4. Summarizing discussion

- Significant heterogeneity of the SS;
- significant level HMND was achieved with pelletization and with additive;
- additive, biochar from waste wood, is assumed to increase the surface area and the HM fixation in biochar;
- significant reduction Hg was achieved by MP and Hg was transported to pyrolysis gas and oil.

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5. Conclusion

- AdMaS focused on methodology for determination of HM fixation by MP;
- MP can be considered as suitable available technology for eco-friendly disposal of SS or different waste material to produce resources for agricultural use;
- following research will be focused on BRC sequential method for determination of HM and additives.

Thank you for your attention

Questions???