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ENERGETIC VALORISATION OF SUNFLOWER AND MAIZE CROPS USED IN PHYTOREMEDIATION OF SOIL CONTAMINATED WITH HEAVY METALS

Environmental and industrial biotechnology (Bioenergy, bioremediation)

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Body

Phytoremediation is an attractive low-cost solution for soil requalification which stabilizes the site with a vegetable cover, avoids the dispersion of pollutants and removes contaminants from the brownfield. The use of energetic cultures to perform soil remediation in heavy metal (HM) contaminated sites contributes to the sustainability of phytoremediation strategies. Sunflower and maize are among the most studied species for the remediation of HM-contaminated soils. The residues from the crop harvest are an attractive by-product with high economic and environmental value. Anaerobic digestion is an effective technology for valorisation of crop residues, by producing renewable energy and reducing the agricultural waste. Despite this, the anaerobic processes can be sensitive to the HM present in the crops. In this way, the anaerobic digestion of plants used in phytoremediation must be investigated to understand if HM toxicity could lead to process upset.

Sunflower and maize were grown for 5 months in a contaminated industrial soil and in a non-contaminated agricultural soil (control soil). After growth, plants were harvested, stalks and roots were separated, dried and grinded and used as carbon and energy source for performing anaerobic digestion assays. Different inoculum to substrate ratios (VS based) were tested (1:1, 1:2 and 1:4) using anaerobic granular sludge from a full-scale reactor as inoculum. Biogas was analysed through gas-chromatography. A higher methane production was obtained from maize stalks compared to maize roots, but not for sunflower, which presented similar results between the digestion of stalks and roots. It was also observed that methane production from maize stalks was twice higher compared to sunflower stalks. Despite obtaining a lower methane production from crops grown in industrial soil, the increased addition of stalks/roots did not affect methane production, indicating a negligible effect of HM on the anaerobic digestion. Overall results indicated that HM effect might be more relevant during plant growth than during the anaerobic digestion of crop residues. This study shows that anaerobic digestion is a solution for the energetic valorisation of sunflower and maize crops used in phytoremediation.

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Palavras-chave : Phytoremediation, Heavy metals, Bioenergy, Anaerobic digestion, Soil, Energetic crops