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Keywords:

Treatment plant, leachate, waste processes, fertilizers.

Abstract

Leachate liquid streams originated from treatment plants contain carbon, nitrogen, phosphorus, potassium and trace elements. The present work aims to assess if a leachate, generated from a composting line of a mechanical and biological treatment facility, can be used as a potential source for liquid fertilizers, and thus propose and design a sequence of processes which could effectively convert the leachates to commercial liquid fertilizers according to the requirements of the proposal of regulation of the European Parliament of 2016. The analysis shows that the leachate exhibits potential to be converted in an organo-mineral fertilizer, since it exhibits high organic carbon content. However, some heavy metals and nitrogen and phosphorous nutrient contents do not fulfill the legislation requirements which implies a tuning of the liquid waste composition.

1. Materials and methods



Fig. 1. Samples and Analyses.

2. Results and discussion

Table 1. Chemical properties of original and concentrated leachates.

Samples	% TOC	pH	Density [g/cm ³]	Dry Mass [%w/w]	Ash [%w/w]	
EU 2016	3.00	-	-	<60	-	
Jun 2018	Original	1.22	7.95	1.01	2.76	1.36
	3.19x	3.64	6.43	1.04	8.26	4.31
	3.23x	3.63	6.44	1.04	8.21	4.23
	3.33x	3.46	6.40	1.04	8.58	4.39
	4.23x	4.65	6.48	1.06	11.19	5.64
	4.39x	4.63	6.49	1.06	11.26	5.81
Feb 2019	Original	2.81	7.53	1.03	6.49	3.07
	Original Filtered	2.79	7.81	1.03	6.02	2.96
	1.19x	3.27	7.98	1.04	7.03	2.93
	1.85x	5.36	6.55	1.06	11.43	5.59

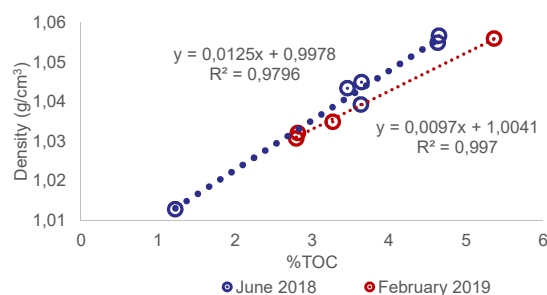


Fig. 2. Correlation between Density and TOC.

Table 2. NP content.

Sample	TKN [%w/w]	Organic [%w/w]	P ₂ O ₅ [%w/w]
EU 2016	2	0.5	2
Jun 2018	0.0588	0.0453	<0.02
Feb 2019	0.3391	0.2617	<0.02

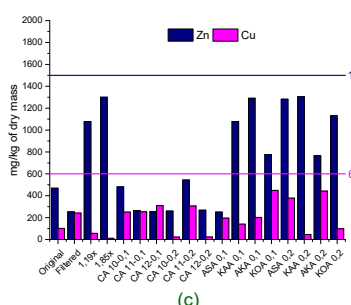
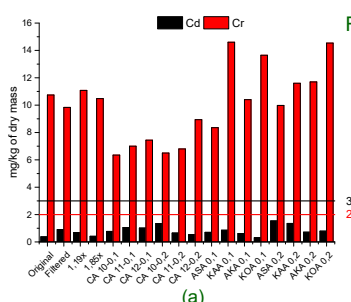


Fig. 3. Proposed simplified flowsheet for a conversion process of the leachate to commercial fertilizers.

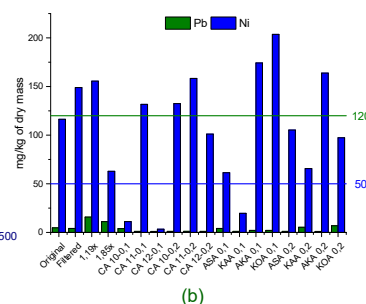


Fig. 4. Heavy metals content of treated samples by adsorption with Activated Carbons (CA) and Activated Clays: (a) Cd and Cr; (b) Pb and Ni; (c) Zn and Cu.

3. Conclusion

The concentrated leachate is not suitable, at this point, to be used as a commercial fertilizer, because it does not fit the totality of the legislation requirements. However, this processed waste leachate samples still display potential to be used for this type of applications, since it exhibits high concentrations of total organic carbon. Heavy metals content must be tuned, possibly resorting to adsorption materials. Nutrients like nitrogen and phosphorous are present in low levels even after the concentration procedure. Ultrafiltration or reverse osmosis processes are possible viable solutions to remove the excess of water without affecting significantly the content of the product in desirable compounds, especially nutrients and organic carbon. Potassium determination remains to be carried out and if it fits the legislation specification. However, the potential use of these leachate wastes as fertilizers is substantial, especially because it encourages the use of liquid wastes with high organic carbon content for agricultural applications with the possibility of producing a high value-added material.

Overall the activated carbons (CAs) produced from the compost showed better results in heavy metals removal. However, while the adsorption materials promoted a reduction in the heavy metals content in most cases, this reduction also affected the organic carbon content, which is not an intended effect since it affects negatively the fulfillment of the TOC requirements. Nevertheless, ion-exchange resins will be now tested for a more efficient heavy metals removal in order to minimize possible secondary elimination of useful components such as organic carbon or nutrients.

Acknowledgments

This work was financially supported by: Project VALORCOMP, funded by FEDER through Programme INTERREG V-A Spain-Portugal (POCTEP) 2014-2020 and Associate Laboratory LSRE-LCM-UID/EQU/50020/2019-funded by national funds through FCT/MCTES (PIDDAC).