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Research area: General aims

Environmental technology // Waste and residues

Key words:

Paper sludge, deinking sludge, biogas, residues, paper mill, MBT, digestion, fermentation

Title:
Co-fermentation of paper sludges (Phase 2)

Background/Problem area

At present, a search should be made for new recovery routes that make sense from the perspective of energy and climate change and are cost-effective for the paper industry in order to dispose of paper sludges. The disposal routes realised to date for direct spreading and for composting with subsequent spreading will no longer be possible in future. The energy recovery of paper sludges in external incinerators is expensive. The energy/material recovery in brickworks and cement plants is only sensible to a limited extent. Hence, paper mills and disposal contractors are searching for an alternative route for biological recovery.

So, the first phase of the research project was therefore devoted to the objective of making the sludges and organic residues from the paper industry accessible to co-fermentation.

An examination of the composition of the paper sludges during the phase 1 of the project yielded very low heavy metal contents. The contents of organic chlorine compounds were in a range that is commonly found in the contents of the fermenters in fermentation plants. This applies as well to the mineral oil contents of primary sludges and biological sludges. The contents of mineral oil, that is used in papermaking and is found in paper for recovery, concentrate primarily in the deinking sludges. The contents in the deinking sludges, however, do not exceed the concentrations found in printed paper. These results do not suggest any inhibition during fermentation, even if as much as 100 % deinking sludge were added. This has already been verified within the framework of the adapted fermentation and inhibitor tests.

When compared with other fermented substances (e.g. corn silage, organic waste), the results of the gas yield test showed that paper sludges can have similarly high gas yields in some cases. In this context, the types of sludge differ from one another far less than do the individual sludge samples within one type of sludge. The methane contents in biogas, for example, range between 52 % and 70 %.

This means that most sludges of the paper industry are very well suited for co-fermentation and can function as a co-substrate, thus providing a good supplement. The degradation behaviour of the paper sludge in a continuous trial should be analysed in detail in every individual case prior to practical implementation. Moreover, the profitability of this alternative disposal route must also be examined.

Objectives/Research results

Having determined that paper sludges are in principle very well suited for co-fermentation, the next phase 2 was focused to studying the practicability of the co-fermentation of paper technological sludges by laboratory testing. For this purpose, the batch trials were prolonged in the form of continuous trials, in order to clarify whether the positive potentials of the co-fermentation of paper sludges that have been discovered can be implemented in day-to-day operation. An addition of 10 % organic substance by deinking sludge resulted in an additional gas yield of 4.9 % - 6.5 %. An addition of 10 % organic substance by fibre sludge resulted in an additional gas yield of 8.2 % - 9.5 %.

The addition of deinking and fibre sludge resulted in no significant inhibition and smaller gas yields of the standard substrate. Examinations concerning the practicability and handling of the paper sludges have shown that in a commercial realisation the adaptation of the flocculation reagent to reduce viscosity in the process water should be adapted. Furthermore, the contents of heavy metals and mineral oil as well as the fluorinated compounds (Perfluorcarbone, PFC) are in a not critical area.

In a subsequent third phase, the results and findings should then be implemented on a commercial scale in a pilot or demonstration plant.

Application/Economic benefits

The co-fermentation of paper sludges is in a range of average costs comparing with other types of disposal. Therefore, the co-fermentation of numerous fibrous paper sludges can be an economic attractive alternative disposal. If the savings and the benefits of a using of the biogas yields are taken into account, the economic efficiency of this disposal way increase significantly, so that the co-fermentation is also interesting for deinking sludges.

Period of time: 01.04.2016 – 31.03.2017

Remarks

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