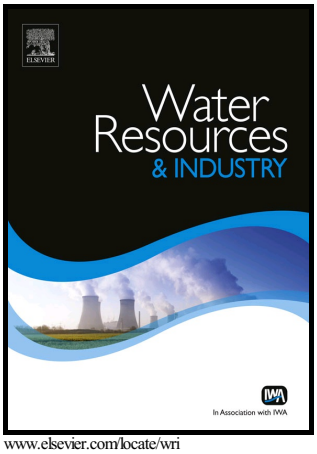

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THE ROLE OF ORGANIC LOAD AND AMMONIA INHIBITION IN ANAEROBIC DIGESTION OF TANNERY FLESHING

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Abstract

In this study, batch tests on anaerobic digestion of tannery fleshing (skin-residue waste from hides' tanning process), as sole substrate, have been performed with the purpose of assessing the effects of high substrate concentration and consequent ammonia inhibition on the process. Co-digestion with tannery primary sludge was also evaluated. According to the results, no inhibition occurred at initial organic load up to 5 gVS/l; an inhibited steady state was observed at 10 gVS/l, and system failure and instability was showed at the highest load of 20gVS/l. Co-digestion with tannery primary sludge proved feasible, probably due to dilution effect. The observed ammonia and VFA accumulation over the experimental time-lapse is also discussed. Results are intended to increase knowledge on the technological application of anaerobic digestion of sole tannery fleshing, in the perspective of its application as on-site treatment solution for decentralised tanneries.

Keywords: Anaerobic digestion; tannery waste; ammonia inhibition; organic load.

1. Introduction

1.1 Tannery wastes

Tannery industry is among the most polluting activities due to the high production of wastewaters and solid wastes [1]. When tannery industries are organized as concentrated district, tannery wastewaters are treated in dedicated industrial wastewater treatment plants, where the production of tannery primary sludge and secondary sludge is massive. Leather tanning is a multi-step sequential process comprising pre-tanning, tanning and crusting, and refinishing operations [2]. Therefore, tannery solid wastes may vary widely in terms of quantity and quality depending on the process phase they have been generated from. Most pollutant load is generated in pre-tanning and tanning operations [2]. Pre-tanning solid wastes comprise mainly hairs, skin trimmings and fleshing. Tanned solid wastes such as wet-blue trimmings and shavings, carry the additional polluting load associated to tanning agents, i.e. chrome or tannins. Tannery fleshing (TF) is originated by the removal of the tissue adhered to the animal hide, usually after liming treatment and before tanning process and is characterized by high proteinaceous organic content, low C/N ratios, and high levels of chemical salts, since hides are usually preserved with sodium chloride and undergo liming and pickling treatments. TF and TPS have been traditionally handled trhough landfill disposal and incineration [3], due to the high content in chemical pollutants and the presence of recalcitrant compounds. Though, in response to new stringent regulations and environmental policies encouraging alternative eco-friendly treatments, anaerobic digestion (AD) turned an attractive solution in the perspective of sustainable and integrated management of tannery solid wastes and wastewaters. Besides AD, other alternative treatments have been proposed in order to divert fleshing and other leather wastes from final landfill disposal or incineration, in favour of energy and/or resource recovery. Some of the reported bioconversion treatments include: production of proteolytic enzymes from fleshing fermentation [18]; composting [10]; recovery of tanning agents [19]; biodiesel production [20]. Additionally, physico-chemical treatments have been applied to TF