Cork wastes treatment and biogas production

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1. Introduction – Cork industry is an important economic and social sector in the western Mediterranean region. Portugal is the producer and processing leader of this sector. The cork processing industry gives rise to several effluents that must be treated and valorised.

This work is a part of a study that aims to develop an integrated process in order to maximize the valorization of the different wastes/effluents of the cork processing sector taking in count the biorefinery concept. The main objective of the present work is to conduct a survey of all operations involve in the cork processing and identify the possible effluents which may be treated and valorise by anaerobic digestion for energy production.

2. Experimental - Several cork processing factories were visited. The cork stoppers processing factories visited were located in the municipality of Vila da Feira (north of Portugal), a cork preparation factory in Álcacer do Sal (south of Portugal) and the insulation corkboard production unit was located in the area of Abrantes (center of Portugal). These visits allowed us to study the processing steps and to identify and collect the different kind of effluents.

The evaluation of the CBW treatment and simultaneous recovery of its energetic potential (methane production) through anaerobic assays were carried out to determine the gas potential and biodegradability of the substrate, using a mesophilic anaerobic consortium, performed at different CBW concentrations of kg COD m^{-3}. CBW was collected in one representative cork preparation unit (cork boiling). The experimental work on CBW was carried out as described in [1].

3. Results and discussion – The total quantity of cork produced worldwide is nowadays referred as being of about 200,000 ton/year and Portugal produces about half of this. This quantity represents all cork types (virgin cork, reproduction cork, winter virgin cork). Different cork raw materials (e.g. cork from forest and cork processing wastes) are used for different cork products. The global cork processing scheme is shown in Figure 1.

As can be seen, cork processing is a complex process, since there are a great variety of raw materials and very diverse cork products for different applications. There are three main groups of processing steps: natural cork stoppers production, insulation corkboard production and composition cork production (stoppers, floor and wall coverings, rubbercork, gifts …). The two production steps considered in this study are for cork stoppers and insulation corkboard. From these two operational phases, several wastes are obtained: the cork coiling wastewaters (CBW), the CBW sludge (CBWS) and the cooling waters (CW) after agglomeration of the insulation cork blocks.

CBW is the most quantitatively important and volumes of more than 30,000 m^3/year, only in Portugal [2], can be obtained. CBW constitutes an environmental hazard due to his complex composition and polluted load contents. It is a liquid stream which is produced during the boiling of the cork planks. This process step is one of the key operations in cork processing mainly for cork stopper production (Figure 2).

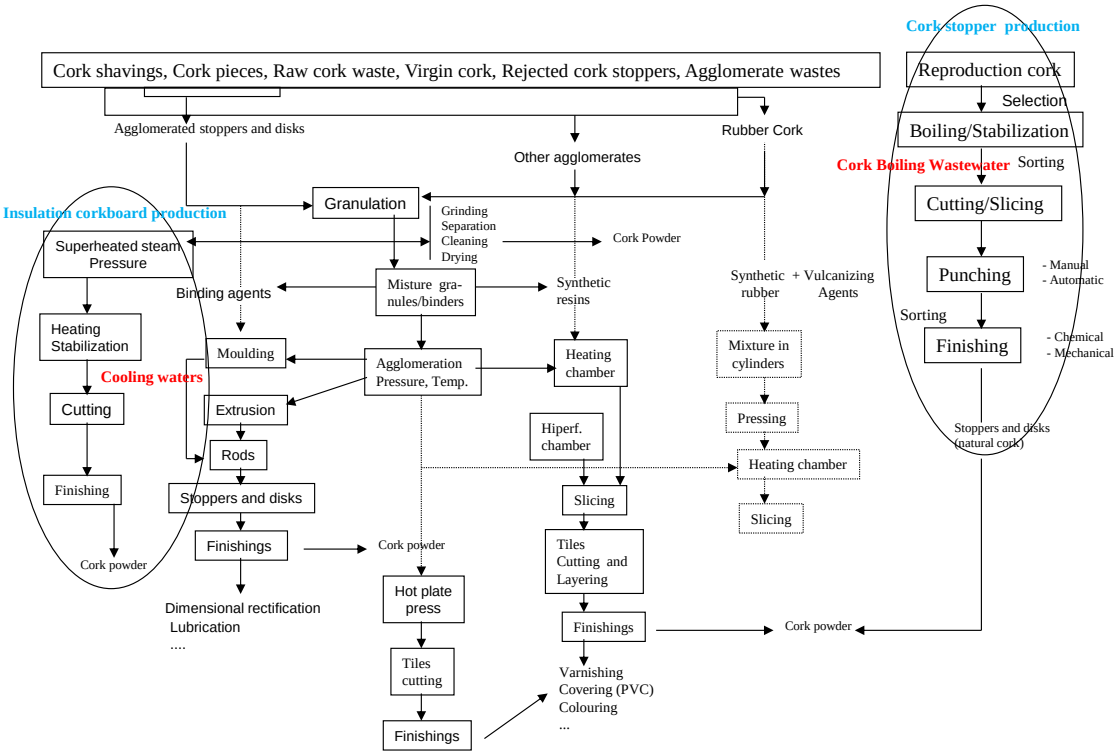

Figure 1 – Global scheme of cork processing

Figure 2 – Traditional cork boiling operation

When CBW is drained, CBWS remains and has to be removed and collected (in the boiling tanks or in the settling tanks). This sludge comprises great water content and organic compounds. It is very difficult to quantify because it depends on the type of cork processed, and there are no records of this waste.
After agglomeration of the cork particles through superheated steam, cork blocks become very hot (> 200 ºC) and have the risk of ignition. So, they must be wetted and cooled. This is carried out with water at a temperature of about 90 ºC, in order to not give rise to thermal stress. This CW cools down the blocks of cork agglomerated material but extracts organic compounds and removes other materials from the cork mass. CW is also very difficult to quantify as it depends on the ignition conditions (air flow, air temperature, lignocellulosic impurities, etc.).

CBW is a hard substrate, characterized by an unbalanced composition, low biodegradability, deep dark colour and toxic/inhibiting capacity. According to [1], the test results showed that CBW has an energetic potential of about 0.0134 m^3 CH4 kg^{-1} COD_{added} and so the polluting organic load contained in CBW can be converted into an energy carrier gas.

4. Conclusions –There are two liquid effluents (CBW and CW) and a solid waste (CBWS) in cork processing which can be used for energy production. The treatment of CBW by anaerobic digestion is an important process as it works as a treatment process and, additionally, as an energetic valorization of the substrate through biogas production. The energetic potential of CBW has direct application in the cork processing operations while the digested flow can be used in the cork oak forests to increase the soil organic matter. Based on these results further work will be carried out with other wastes from the cork industry, as previously described.

5. Referências

[1] M. R. Gonçalves, L. Gil, I.P. Marques, Cork boiling wastewaters management by anaerobic digestion, 4th Int. Conf. Eng. Waste & Biomass Valorization, Porto, 10-13 Sep. 2012, p.489-494.
[2] I.P. Marques, L. Gil, Energetic potential of cork processing wastewaters, International Congress on Water, Waste & Energy Management, Salamanca, 23-25 May 2012, p.43.