Comparison of two valorization processes of wastes generated by fruit waste antioxidant compounds extraction.

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Industrial processing of berries, so called red fruits, into juice and jam generally results in approximately 20-30% (*w/w*) of pomaces production. Organic valorization of these waste is problematic for different reasons. The organic matter load of these co-products gives them a pollutant character linked to the important releases of greenhouse gases during their biodegradation following the spreading. Composting is partially inhibited due to the presence of compounds with high antimicrobial capacity. These food by-products are rich in essential omega fatty acids and contain high amounts of dietary fiber and bioactive compounds such as tocols, phytosterols, ellagic acid and flavonoids. These components have recently attracted a lot of attention for their potential health-promoting effects. Under optimum conditions, high added-value components are recovered. The resulting aqueous emulsion is easily freeze dried and presents high antioxidant activity according to DPPH and ORAC assays. These press cake extract may be a promising ingredient for cosmetics, nutraceuticals and other applications. Nevertheless a part of the product still remain as a “pulp waste”.

The objective of this work is to investigate different pathways for these specific sub-products valorization (pulp waste). Two valorisation processes were chosen: anaerobic digestion for biogas production and geopolymers synthesis for use in construction. Geopolymers are new materials of great interest because they are energy efficient and have low environmental impact. They result from the activation of an aluminosilicate source (such as metakaolin) by an alkaline solution.

Biomethane potential tests were achieved at labscale using digested sludge as inoculum, under mesophilic conditions (37°C). The ratio between inoculum and solid waste was fixed in terms of volatile matter VM to ¼ (inoculum) ¾ (waste). Each tests were achieved in triplicate and compare to a negative control. Geopolymers synthesis was achieved according to the protocol described by Gharzouni et al. (2017).

Strawberries pulp reach an interesting potential of methane production after a few days while rapsberry and gooseberry pulp led had low kinetic and low biogas production (Figure 1).

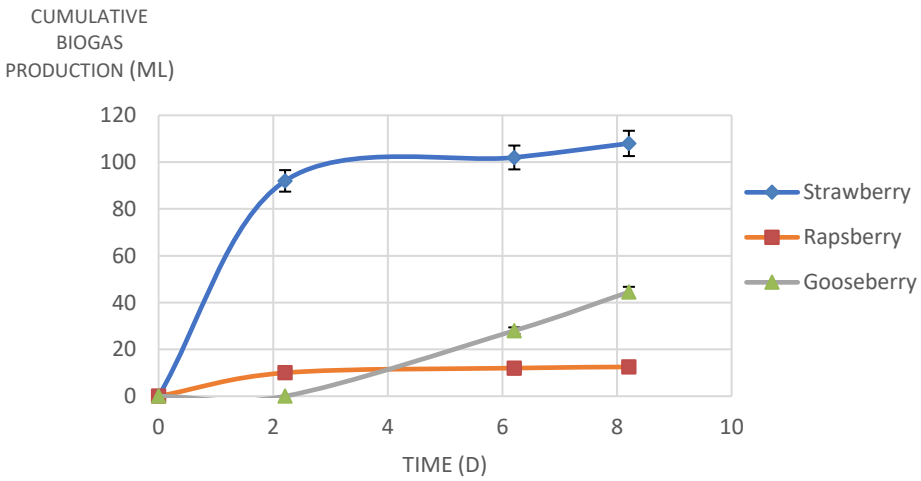

Figure 1 : Cumulative biogas production during BMP tests of strawberry, raspberry and goosebery pulps

An innovative way of valorization was the investigation of the suitability of raspberry and gooseberry pulps to produce geopolymer materials. A known metakaolin based geopolymer composition was used as reference. Then, the metakaolin was progressively substituted by raw or calcined raspberry and gooseberry pulps at 300 (Fig 2.a and b). The feasibility pf consolidated materials tests have shown the possibility of inserting raw fruit marks into geopolymer compositions in substitution of metakaolin at the level of 20%. It is also possible to substitute the metakaolin with fruit pulps calcined at 300 °C at the level of 50% (Fig 2.c).

Figure 2 : (a) Raw, (b) calcined at 300°C gooseberries pulp and c) geopolymers obtained from calcined pulp.

This work showed that the valorization of pulp extracted wastes is completely different from one fruit to another, but they can easily join circular economy systems through biogas or geopolymers production. Other data not shown aimed to combine “pulp waste” co-methanisation with geopolymers synthesis from digestat resulting from anaerobic digestion of berries pulp.

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A. Gharzouni, I. Sobrados, S. Balouti, E. Joussein and S. Rossignol. **Control of polycondensation reaction generated from different metakaolins and alkaline solutions, J** of Ceramic and Technology, 8(3) 2017, 365-376.