Production of Bioethanol from Sweet Potato, Agro-Industrial Wastes

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One fraction of the existent petroleum is not extractable or the difficulties associated to extraction are very expensive making them unviable. This situation leads to a decrease in petroleum stocks all over the world and a resulting increment on its price, affecting in particular the transportation sector, since there is no relevant alternative to fossil petroleum.

In addition, the recent concern about the environmental deterioration from the over consumption of petroleum derived products, which highly contributes to the greenhouse effect, is threatening the sustainability of the human society. For these reasons, the search for clean and renewable sources is one of the highest challenges of mankind nowadays.

Biomass is one of the oldest and the most promising energy sources and includes organic and animal wastes, wastewater, energy crops, agricultural and industrial residues that can be used for the production of biofuels. It can be biologically converted to liquid or gaseous fuels, such as ethanol, methanol, methane and hydrogen [1].

Bioethanol is obtained from plant materials that are produced by photosynthesis, which is a photochemical process that uses atmospheric CO_2. When the bioethanol is burned, it liberates CO_2 that returns back to the atmosphere, where it came from. It means that the balance between CO_2 consumption and liberation is preserved and use of bioethanol as a source of power could partially help to solve the global ecological problems such as the greenhouse effect and global warming [2].

Currently, ethanol is the main biofuel used in the world and its use is being progressively widespread, arising also the need for new and more yielding sources of ethanol and processes of production.

Ethanol industry requires sufficient and cheap feedstock in order to reduce the costs of production. To avoid competition with materials conventionally destined to food, ethanol industry should be based on non-grain crops and biomass [3].

In Portugal, region of Algarve, Aljezur is a town with great sweet potato tradition and high output of sweet potato. The sweet potato of Aljezur is the adventitious, fleshy, tuberous root of the plant *Ipomoea batatas* (L.). Elongated and pear shaped, its skin is purple or reddish brown and the flesh yellow.

Saccharomyces cerevisiae, a Crabtree-positive yeast, is capable of growth and ethanol production under both aerobic and anaerobic conditions being extensively used to convert sugars to ethanol for the production of biofuels [4]. The strain used during this work is a high ethanol tolerant strain and allows to attain high yields and productivities.

The aim of this work is to study the fermentative process for production of bioethanol using sweet potato agro-industrial wastes. Soluble sugars were extracted using different experimental procedures. A value of 75.8 g/L in total sugars was achieved, for sweet potato at an optimized ratio of 2:10 (w/v) in aqueous medium, using a heat treatment at 110 ºC for 90 min.

Soluble sugar fermentations were performed in Erlenmeyer flasks, with YEPD medium at 30 ºC and 150 rpm (Figure 1), using extract of sweet potato as carbon source.

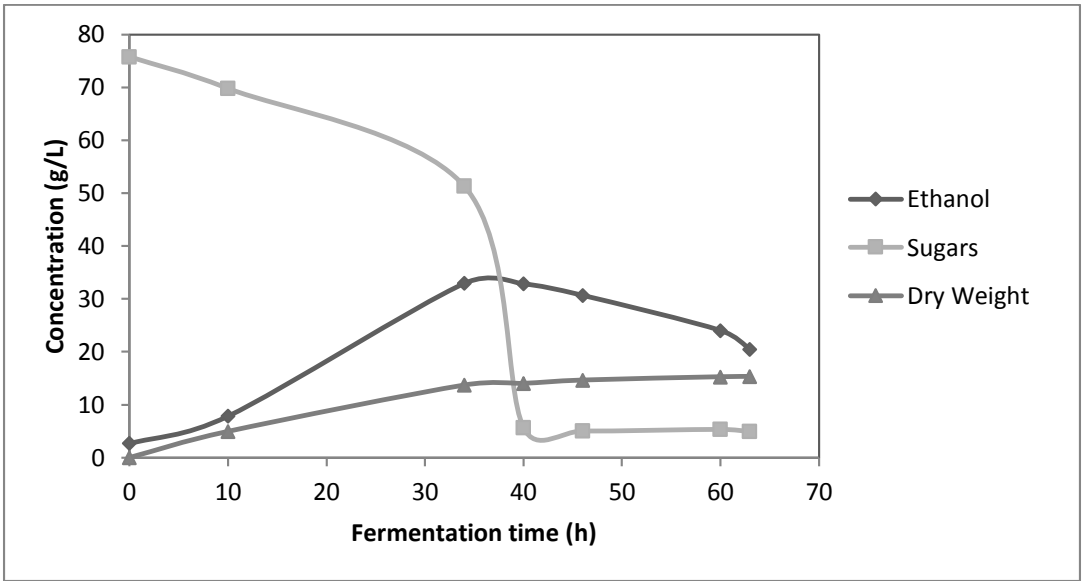

Figure 1 – Concentrations (g/L) of ethanol, total sugars and dry weight during fermentation process times (h), with YEPD medium at 30 ºC and 150 rpm.

Maximum ethanol concentration, maximum ethanol productivity and yield after fermentation were respectively 32.9 g/L, 0.89 g/(L.h) and 43 %. These high values were achieved using soluble sugars of sweet potato extracted at mild conditions.
An enzymatic hydrolysis of starch has to be applied in order to increase carbon source availability and consequently the amount of ethanol produced.

References

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