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Structural and Morphological Characterization of the Biomass of Aquatics Macrophyte (Egeria densa) Submitted to Thermal Pretreatment

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Abstract : The search for alternatives to control hunger in the world, generated a major environmental problem. Intensive systems of fish production can cause an imbalance in the aquatic environment, triggering the phenomenon of eutrophication. Currently, there are many forms of growth control aquatic plants, such as mechanical withdrawal, however some difficulties arise for their final destination. The Egeria densa is a species of submerged aquatic macrophyte-rich in cellulose and low concentrations of lignin. By applying the concept of second generation energy, which uses lignocellulose for energy production, the reuse of these aquatic macrophytes (Egeria densa) in the biofuels production can turn an interesting alternative. In order to make lignocellulose sugars available for effective fermentation, it is important to use pre-treatments in order to separate the components and modify the structure of the cellulose and thus facilitate the attack of the microorganisms responsible for the fermentation. Therefore, the objective of this research work was to evaluate the structural and morphological transformations occurring in the biomass of aquatic macrophytes (E.densa) submitted to a thermal pretreatment. The samples were collected in an intensive fish growing farm, in the low São Francisco dam, in the northeastern region of Brazil. After collection, the samples were dried in a 65 0C ventilation oven and milled in a 5mm micron knife mill. A duplicate assay was carried, comparing the in natural biomass with the pretreated biomass with heat (MT). The sample (MT) was submitted to an autoclave with a temperature of 1210C and a pressure of 1.1 atm, for 30 minutes. After this procedure, the biomass was characterized in terms of degree of crystallinity and morphology, using X-ray diffraction (XRD) techniques and scanning electron microscopy (SEM), respectively. The results showed that there was a decrease of 11% in the crystallinity index (% CI) of the pretreated biomass, leading to the structural modification in the cellulose and greater presence of amorphous structures. Increases in porosity and surface roughness of the samples were also observed. These results suggest that biomass may become more accessible to the hydrolytic enzymes of fermenting microorganisms. Therefore, the morphological transformations caused by the thermal pretreatment may be favorable for a subsequent fermentation and, consequently, a higher yield of biofuels. Thus, the use of thermally pretreated aquatic macrophytes (E.densa) can be an environmentally, financially and socially sustainable alternative. In addition, it represents a measure of control for the aquatic environment, which can generate income (biogas production) and maintenance of fish farming activities in local communities.

Keywords : aquatics macrophyte, biofuels, crystallinity, morphology, pretreatment thermal
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