Thesis Title : **Energy recovery of cassava waste and water hyacinth for biofuel production in Republic of Benin**

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Abstract: Cassava processing in Republic of Benin poses a threat to the environment due to pollutant organic wastes discharged. Moreover, cassava industries put a high pressure on biomass resources in order to cover its internal energy needs. My PhD study aimed to produce second generation biofuels (biogas and bioethanol) from cassava peels (CP) cassava wastewater (CWW). Cassava wastes characterization revealed a high carbohydrate content of CP against low nitrogen content. It was therefore necessary to proceed to anaerobic co-digestion of CP with water hyacinth (WH), which is an aquatic plant rich in nitrogen and invade most of Benin water stream. The biochemical methanogenic potential (BMP) tests of the different substrates were close to stoichiometric potentials obtained by calculation. However, in the 500 mL batch reactor tests, it was necessary to pretreat CP with potash locally called *"akanwu"* and phosphate buffer pH 7.2. The cumulative average methane yields were 368 mL/gVS; 309 mL/gVS and 178 mL/gVS respectively from CWW, CP and WH after a solid retention time (SRT) of 15 days of CWW and 7 days of CP and WH. Co-digestion of CP with WH yielded an average of 211 $mLCH_4$/gVS after a SRT of 10days. Despite that methane yield of co-digestion was lower than the summative methane yield of each substrate, the process has removed the chemical products then improved CP treatment. Moreover, cumulative methane yield of WH has increased by 10% when co-digested with CP. Furthermore, the methanogenic potential at pilot scale of co-digestion of CP and WH in a 75 L reactor with an useful volume of 30L loaded at 1kgVS/m^3.day under an average hydraulic residence time (HRT) of 30 days was close to the results showed in a BMP tests. The maximum cumulative yield was 240 $mLCH_4$/gVS after a residence time of 7days of the substrates.

On other hand, wet oxidation pretreatment of CP and WH for ethanol production purpose revealed that WH requires less energy to be delignified. Ethanol yields from the supernatant of pretreatment of CP and WH were respectively 309.6 mg and 197.2 mg per liter.

Finally, the theoretical study done in order to implement a 75m^3 anaerobic digester in a cassava processing unit in Republic of Benin has shown that the technology could annually save 30 tons of firewood, equivalent to 1,800€ to the company.

Keywords: Anaerobic digestion; Bioethanol; Biogas; Cassava waste water hyacinth; Methanogenic potential.