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CASSAVA STARCH-DERIVED NANOCARBON DOTS BY HYDROTHERMAL CARBONIZATION FOR DISTILLERY SPENT WASH TREATMENT

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INTRODUCTION

Distillery spent wash is considered as one of the critical environmental issue as 88% of the raw materials are converted into waste and discharged into bodies of water causing serious water pollution.

Adsorption has been known to be highly efficient in minimizing the impact of industrial effluents by trapping pollutants on an adsorbent's surface. The most common adsorbent used is activated carbon (AC) but cheaper and more efficient substitutes are continually sought in order to improve the quality of water treatment.

Nanocarbon dots (NCDs) are spherical, nontoxic, biocompatible and discrete particles less than 10 nm in diameter. NCDs have a larger surface area thus requires less material when used as substitute to AC in spent wash treatment. A low cost, environmentally friendly, and nontoxic route to production of NCDs is hydrothermal carbonization (HTC). HTC converts raw biomass such as starch into a coal-like product called hydrochar which has a high carbon content and calorific value.

Cassava is a good source of starch is produced in the country at a about 1.8 million metric tons making it a viable source for NCD production.

This study aimed to produce of nanocarbon dots from starch using hydrothermal process and explore its extent as an adsorbent for spent wash treatment in terms of BOD, color and TSS removal and pH neutralization in contrast to activated carbon.

This study also sought to determine the percent yield of starch from cassava, the percent yield of NCD from cassava starch, and the characteristics of the NCD in terms of diameter, surface area, and shape.

This study provides benefit to various sectors such as distillery industries, LGUs and NGAs, the community, the environment and the academe.

CONCLUSIONS & RECOMMENDATIONS

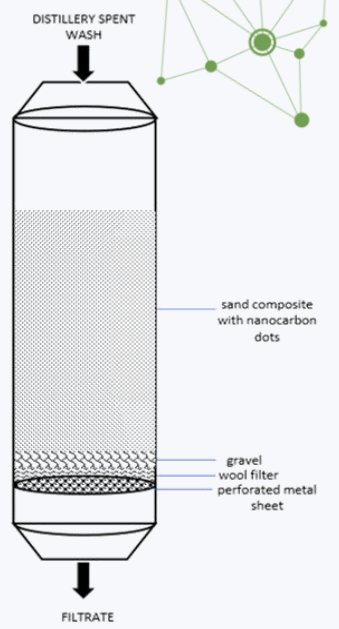
The results indicated that AC showed better performance in removing BOD and reducing pH. On the other hand, NCD had better performance in removing both color and TSS from the spentwash. It can be observed that the adsorption sites of adsorbents are very effective in removing organics from wastewater.

The set-up with NCD showed the largest reduction in color among the three set-ups indicating better performance for the removal of smaller contaminants in the wastewater. The higher % of removal of TSS by the NCD is due to its large surface area although this attribute was not maximized in the study since the NCD used was in the form of a wet hydrochar. Despite the increasing trend in percent removal, it can also be observed that the results from each set-up are relatively close with each other indicating that adsorbents do not greatly improve the removal of TSS in the filtration set-ups. This is because the particles associated for TSS is significantly larger compared to that of BOD and color thus it can easily be removed from water using filtration even without the presence of adsorbents.

Based on these results, filtration using NCD is recommended as tertiary treatment for spentwash especially for removal of color and TSS.

MATERIALS AND METHODS

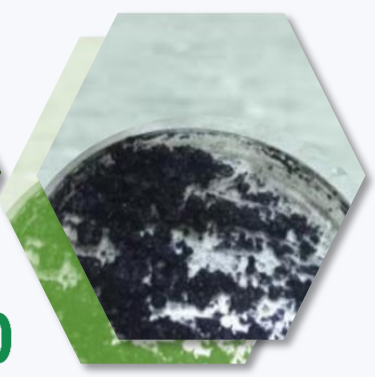
Extraction of Starch from Cassava → Hydrothermal Carbonization → Physical Characterization of the NCDs → Preparation of Downflow Gravity Contactor → Preparation of Spent Wash Samples → Pretest Analysis of Spent Wash Samples → Spent Wash Filtration → Post-test Analysis of Spent Wash Samples → % Removal Calculation & Statistical Tool Analysis



RESULTS AND DISCUSSION

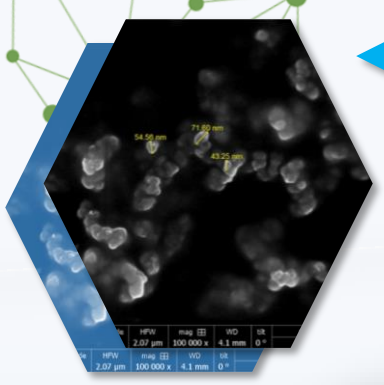
21.22%

69.60%



The percent yield of cassava starch from cassava is 21.22%

The percent yield of nanocarbon dots from cassava starch is 69.60%



FESEM analysis showed that the average diameter of the NCD produced was 62.86 nm with an average surface area of 13,357.21 nm² having a quasi-spherical shape.

UV illuminance indicates presence of nanocarbon dots

Spentwash filtration using downflow gravity contactor showed that NCD as and adsorbent is effective in removing TSS and color.

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