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An efficient hybrid feedstock pretreatment technique for the release of fermentable sugar from cassava peels for biofuel production

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Statement of the Problem: Agricultural residues present a low cost feedstock for bioenergy production around the world. Cassava peels waste are rich in organic molecules that can be readily converted to value added products such as biomaterials and biofuels. However, due to the presence of high proportion of structural carbohydrates and lignin, the pretreatment of this feedstock is imperative to achieve maximum substrate utilization and energy yield. The purpose of this study is to develop an efficient feedstock pretreatment technique that will ensure maximum release of fermentable sugar from cassava peels waste for biofuel production.

Methodology & Theoretical Orientation: The study models optimize the release of fermentable sugar (FS) from cassava peels waste using the response surface methodology. The investigated pretreatment input parameters consisted of soaking temperature (°C), soaking time (hours), autoclave duration (minutes), acid concentration (%v/v), substrate solid loading (%w/v) within the range of 30 to 70, 0 to 24, 5 to 20, 0 to 5 and 2 to 10 respectively. The Box Behnken design was used to generate 46 experimental runs which were investigated for FS release. The obtained data were used to fit a quadratic model.

Findings: A coefficient of determination of 0.87 and F value of 8.73 were obtained indicating the good fitness of the model. The predicted optimum pretreatment conditions were 69.62°C soaking temperature, 2.57 hours soaking duration, 5 minutes autoclave duration, 3.68% v/v HCl and 9.65% w/v solid loading corresponding to FS yield of 91.83g/l (0.92 g/g cassava peels) thus 58% improvement on the non-optimized pretreatment.

Conclusion & Significance: Our findings demonstrate an efficient pretreatment model for fermentable sugar release from cassava peels waste for various bioprocesses.

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