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Research Article

Estimation of *Saccharomyces cerevisiae* Biomass Cultured in Cassava Mill Effluents

Sylvester Chibueze Izah*

Department of Biological Sciences, Nigeria

***Corresponding author:** Sylvester Chibueze Izah, Department of Biological Sciences, Faculty of Science, Wilberforce Island, Bayelsa State, Nigeria

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Abstract

This study assessed the quantity of *Saccharomyces cerevisiae* biomass recovered from cassava mill effluents after 15 days of incubation. The *Saccharomyces cerevisiae* used in this study were isolated from palm wine, while the cassava mill effluents were obtained from rural community in Delta state, Nigeria. The raw effluents were filtered with double muslin cloth. Then after, it was heat treated before inoculating 10ml of *S.cerevisiae* inoculum into the 100ml cassava mill effluents in 250 flasks. The medium were shaked intermittently throughout the period of the study (15 days). Then after, the medium were carefully decanted and the resulted sludge was filtered using Whatman filter paper. The recovered biomass trapped in filtered paper was washed with distilled water and re-filtered. The recovered biomass was oven dried and weighed. The biomass recovered was 3.93±0.55g/L. The study showed that *Saccharomyces cerevisiae* biomass can be cultured in cassava mill effluents. Therefore, the use of *Saccharomyces cerevisiae* can be used to treat cassava mill effluents while generating biomass that can be utilized for other downstream application. Hence, there is the need for optimization of biomass produced through manipulation of the environmental parameters.

Keywords: Biomass; Biotechnology advances; Environment pollution; Cassava mill effluents; Treatment

Introduction

Yeast is a unicellular microorganism that belongs to the division of *Ascomycota* and *Fungi imperfecti [1]*. Several species of yeast exist. Some of the common genera of yeast include *Rhodotorula, Candida, Trichosporon, Saccharomyces, Kluyveromyces, Pichia, Trichospora, Torulopsis, Leucosporidium, Hansenula, Torula, Cellulomonas, Xanthomonas and Schizosaccharomyces* [1,2]. Like bacteria and mould, some species of yeast are pathogenic to humans especially on immune-compromised individuals. While several species play beneficial roles in humans health as well. *Saccharomyces cerevisiae* is among the grass organisms that have been implicate with food safety. Like some species of *Lactobacillus, Saccharomyces cerevisiae* have several foods and feed potentials [2,3]. Reethus et al. [3] reported that *Saccharomyces cerevisiae* is mainly used in animal, while Saccharomyces boulardii is the most commercially used probiotics (a live microbial feed supplemented to animal diets to enhance the balance of microbes found in the intestines). *Saccharomyces cerevisiae* are widely used in fermentation processes of sugar rich substances such as cassava wastes [4,5], grapes, sugarcane, fruit wastes [3].

Saccharomyces cerevisiae can be cultivated under aerobic and anaerobic condition depending on the choice of medium. *Saccharomyces cerevisiae* have the potentials to utilize and grow in diverse sugars especially glucose, sucrose, maltose etc. [3]. Several substrates have been used for the cultivation of *Saccharomyces cerevisiae* including cassava mill effluents [6-9], palm oil mill effluents [10], jagger, pods, fruit wastes, vegetable wastes, banana and orange peels and deoiled cake [3]. Specifically, Nigeria is the largest producers of cassava in the world [4,11,12]. During the processing cassava mill effluents (waste water) is a major liquid wastes that are discharged into the soil without any form of treatment [6-9,13-16]. Thereby causing an alteration in microbial [17] and physicochemical constituents of the receiving soil over a prolong period of time [12]. Studies have indicated that the constituents of the wastes could be improved upon when treated with *Saccharomyces cerevisiae* [6,13].

Saccharomyces cerevisiae cultured in cassava mill effluents contain additive such as palm oil and some level of heat treatment is known to reduce to reduce cyanide content (a major toxicant of cassava) [7], and contain amino acid and proximate composition [8]. Furthermore, Bekatorou et al. [1] reported that *Saccharomyces cerevisiae* is rich in nutrients including proximate composition, minerals (including essential heavy metals and cations), vitamins. Probably due to the role of *Saccharomyces cerevisiae* in animal feed and its industrial application, there is the need to estimate the quantity of *Saccharomyces cerevisiae* biomass from cassava mill effluents.

Materials and Methods

Sample collection

Raw cassava mill effluents containing additive such as palm oil were obtained from a cassava mill in rural community in Delta state, Nigeria. The samples were collected in triplicates. The samples were properly labeled and packaged in an ice crest prior to transportation to the laboratory.

Saccharomyces cerevisae isolation and identification

S. cerevisiae used was bought from palm vendor in Rumuomasi, Port Harcourt, Rivers state, Nigeria. The *Saccharomyces cerevisiae* were isolated following pour plate techniques previously described by Benson [18], Pepper and Gerba [19]. The Potato dextrose agar used was supplemented with chloramphenicol. The resultant microbial isolates were streaked in another Potato dextrose agar plate containing chloramphenicol. The identification of the isolates were based microbiological techniques (i.e. cultural, morphological, and physiological/biochemical characteristics) including carbon fermentation and assimilation, glucose-peptone-yeast extract broth, lacto-phenol cotton blue stain and growth based on temperature as previously described by Kurtzman & Fell [20], Benson [18], APHA [21] and have been applied by Abioye et al. [22], Iwuagwu & Ugwuanyi [10], Okoduwa et al. [23]. The characteristics of the identified isolates were compared with the scheme of Ellis et al. [24].

Biomass cultivation

Wastewater treatment method previously described by Abioye et al. [22], Okoduwa et al. [23] was modified and used for the cultivation of biomass as previously described by Izah et al. [6-9]. Approximately 10.0ml of the cultured *Saccharomyces cerevisiae* inoculum were aseptically introduced into 100ml of sterile cassava mill effluents in 250ml Erlenmeyer's flask. The flask was capped with cotton wool wrapped with aluminum foil paper. The flasks were intermittently shaked between 7.00-19.00 hours. The incubation period lasted for 15 days. During which the about 60ml of the effluents were decanted while the remaining 40ml were filtered through Whatman filter paper. The biomass recovered was washed with distilled water before re-filtering. The final sludge trapped in the filter paper was oven dried, and weighed.

Statistical analysis

The results were expressed as mean±standard deviation using SPSS software version 20.

Results and Discussion

The *Saccharomyces cerevisiae* biomass recovered at the end of the experiment was 3.93±0.55g/L. The value produced was lower than the values reported by previous authors. Some of these values are 4.42 g/L obtained from the culturing of *Saccharomyces* species in palm oil mill effluents [10], 4.0g/l obtained from culturing of Aspergillus niger in palm oil mill effluents [25], 7.5g/l obtained from culturing of Rhodotorula glutinis in palm oil mill effluents [26].,Reethus et al. [3] reported biomass of *Saccharomyces cerevisiae* MTCC 174 and *Saccharomyces cerevisiae* MTCC 3821 as 6.60g/l and 6.74 g/l. respectively for jagger, 4.20g/l and 4.29g/l, respectively for pods, 4.88g/l and 4.94, respectively for fruits wastes. The studies of the authors for vegetable wastes, banana peels, orange peels and deoiled cake has a yield of 3.72g/l, 3.81g/l, 3.35g/l and 3.69g/l, respectively (*Saccharomyces cerevisiae* MTCC 174), and 3.63g/l, 3.80 g/l, 3.54 g/l and 3.77 g/l, respectively (*Saccharomyces cerevisiae* MTCC 3821) and this results were in consonance with the work of this study. The variations could be due to environmental conditions such as temperature and pH of the effluents used. Furthermore, the physical, chemical and microbial concentration of the effluents could also affect the biomass productivity. Ogbonda et al. [27] reported that pH and temperature could affect the yield of Spirulina species isolated from oil polluted estuarine.

Conclusion

This study showed *Saccharomyces cerevisiae* biomass yield of 3.93g/l. This suggests that cassava mill effluents are a promising feed stock for the cultivation of *Saccharomyces cerevisiae* biomass. In addition, during the cultivation some of the pollution indicators such as chemical oxygen demand and pH can be improved upon. Therefore studies should be focused on possible optimization of the biomass through manipulation of the environmental conditions.

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