EC NUTRITION
Editorial

Potentials of Yeast Biomass Production from Food Processing Wastes Effluents

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Food are essential substances required by the body for growth, development and functioning of the various system [1-9]. Food resources are mainly obtained from biodiversity including plants and animals to a large extent. Sometimes, food could also be obtained from microorganisms including some species of algae, bacteria and yeasts. Some microorganisms are also an active ingredient in some food resources such as some species of *Lactobacillus* used for yoghurt production, *Saccharomyces cerevisiae* used in bakery and breweries.

Globally some food resources including rice, wheat, cassava is a major staple food. Also, oil palm tree is the most economic oil bearing plant in the world. During processing of these food resources into specific products especially in developing countries like Nigeria, larges volume of effluents are generated. These liquid wastes are discharged into the environment with little or no treatment, thereby having an impact on the receiving environment including soil, water, and air. The air impact is mainly due to odours emanating from the effluents. Due to the various constituents of the wastes it could alter the soil and water quality parameter. For instance, due to the acidic nature of cassava and palm oil mill effluents, it causes acidification of the receiving environment (soil and water) and eutrophication in the water ways. Again, due to high chemical oxygen constituent of the effluents, the pollution index could be high in the receiving ecosystem. These effluents on the soil and water could inhibit the downstream application of the water and soil.

Several biotechnological advances have been proposed for the effective management of these wastes including energy production (biohydrogen, biogas, bioethanol, bioelectricity), enzymes, etc. These effluents typically contain an array of microorganisms including bacteria and fungi. Some of the microorganisms aid in the degradation of the effluent under suitable environmental condition, thereby leading to the production of other products that could be beneficial or detrimental.

In a review study by Bekatorou., *et al.* [10] reported that several yeast genus *Rhodotorula, Candida, Trichosporon, Saccharomyces, Kluyveromyces, Pichia, Trichospora, Torulopsis, Leucosporidium, Hansenula, Torula, Cellulomonas, Xanthomonas* and *Schizosaccharomyces* have been used to produce yeast biomass from several biomass raw material. Basically, yeast which is a unicellular microbe is of the division Ascomycota and Fungi imperfecti [10].

Yeasts have the tendency to grow in aerobic or anaerobic condition as such its facultative anaerobes. Depending on the production strategy, the bio-products vary. For instance, Bekatorou., *et al*. [10] reported that in aerobic condition, sugar is converted to carbon dioxide, energy and biomass, while under anaerobic conditions, alcoholic fermentation, the sugars are converted to intermediate by-products including ethanol, glycerol and carbon dioxide. From this, yeast biomass production is optimum under aerobic condition. The major source of carbon and energy for some yeast species is sugar – glucose which is used to produce adenosine triphosphate (ATP) - the energy currency of a cell and some metabolites. This is achieved through four major steps including glycolysis, pyruvate oxidation, Krebs cycle and electron transport chain and chemiosmosis. Again, depending on the yeast species, the processes of energy generation from pyruvate can either be through respiration or fermentation [10]. Either of the method its typically regulated by some conditions (including aerobic or anaerobic) as well as the activities that takes place in each process, as the metabolic stages varies. For instance, during respiration, the pyruvate is decarboxylated in the mitochondrion to form acetyl-CoA which is completely oxidized in the citric acid cycle into carbon dioxide, energy and intermediates products [10]. But under anaerobic respiration, glycolysis, the tricarboxylic acid cycle, respiratory chain is involved and molecular oxygen is not utilized in the final electron acceptor. This process is typically slow. Also during fermentation, glycolysis, organic compounds are the final electron acceptors. Either method (respiration or fermentation) adopted, care should be exercised. This is because when yeast cells is subjected to high concentration of glucose catabolite repression arises, and in the process of gene expression [10].

Food grade yeast viz: *Saccharomyces cerevisiae* and *Candida utilis* are used for the production of glutathione [11, 12], which has biosynthesis relationship with three amino acids including cysteine, glycine and glutamic acid [12]. Several forms of yeast exist including brewers, nutritional brewers, wine, distillers, Torula, prebiotic, whey yeast and yeast extracts [10]. Of all the various forms of sugars, glucose, maltose and sucrose are the most widely metabolized forms of carbon by yeast [10]. In addition to carbon, the nutritional requirements of yeasts include nitrogen, phosphorus, trace elements sources and growth factors.

The major yeast used for food purposes include *Saccharomyces cerevisiae* and *Candida utilis*. Of these, *Saccharomyces cerevisiae* which is also known as baker's yeast [13] is the most widely utilized yeast used for bakery and bread production breweries, wineries and distilleries for the production of beer, wine, distillates and ethanol.

Yeasts have several applications including beverages (viz: vinegar, wine, beer) production through fermentation and bread (viz: cheese, sourdough and bread). Beside the role of yeast in bread and beverage production, it has high nutritional properties due to the presence of high quality proteins (including essential and non-essential amino acids), enzymes and vitamins. Yeast is typically rich in nutrients. For instance, Bekatorou., *et al*. [10] reported that *Saccharomyces cerevisiae* contain 30 - 33% (dry matter), 6.5 - 9.3% (nitrogen), 40.6 - 58.0% (proteins), 35.0 - 45.0% (carbohydrates), 4.0 - 6.0% (lipids), 5.0 - 7.5% (minerals and various amounts of vitamins) depending on the yeast on growth conditions. The authors further reported that brewer's yeast (which involves the cultivation of *Saccharomyces cerevisiae* in malted barley) is a good source of vitamin B, Calcium, Phosphorus, potassium, magnesium, copper, iron, zinc, manganese and chromium. Typically, iron, copper, zinc, manganese and chromium are essential trace metals required by living organisms at certain amount. As such the role and associated health impacts of these heavy metals has been comprehensively documented by Izah., *et al*. [1,13]. Blazejak and Duszkiewicz-Reinhard [14] reported that yeast biomass is a good source of magnesium bioplexes. Iwuagwu and Ugwuanyi [15] reported that amino acid profile of yeast produced from palm oil mill effluents is comparable and or superior to the Food and Agricultural Organization/World Health Organization level.

As such they are vital several industries including animal/livestock feeds [15], food (viz: as an additives, conditioners, starter culture and flavouring agents) and media for microbiological works [10]. According to Bekatorou., *et al.* [10] due to high protein content, short growth times, low grade feedstock, fast biomass production, which can be continuous and independent of the environmental conditions are the merits of utilizing microorganisms especially yeast for the production of single cell protein compared to conventional sources of protein which are mainly from soybeans, meat etc.

During the production of yeast biomass, the constituents of the waste water are degraded. For instance, Iwuagwu and Ugwuanyi [15] reported that during food grade yeast biomass from palm oil effluents production using *Saccharomyces, Pichia, Candida* species the pH increased (tending toward alkalinity), chemical oxygen demand decreases as production period increased. Through the utilization of food processing waste effluent for yeast production the environmental impact associated with the wastes water effluents is reduced. Therefore, countries such as Nigeria that produce high volume of waste water from food crops such as oil palm and cassava need harness this waste water through biotechnological applications such as yeast production.

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