

Applied Microbiology 2016- Applications of different agro-industrial wastes in petroleum biotechnology - Nour Shafik Emam El-Gendy-Egyptian Petroleum Research Institute

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Abstract

Millions tons of agro-industrial wastes are produced annually all over the world. These wastes aren't economically reused; create air, soil and pollution that has negative impact on human health, tourism, economy and environment. My talk will briefly summarize how these wastes are often applied to unravel many of pollution, waste management, energy etc; problems for example; bioremediation of various oil polluted environments and our successful effort in real field case studies, bio-upgrading of petroleum and its fractions throughout the appliance of bio-desulfurization, bionitrogenation etc, biosorption and wastewater treatment. Recycling of different kinds of agro-industrial wastes to produce valuable products e.g. Nano-materials, bio-surfactants, biocides, catalysts to be applied in biodiesel production, corrosion inhibitors and green catalyst with high photo-catalytic degradation properties etc. Production of various valuable industrial products from algae, which might have many applications in industries of food, cosmetics, pharmaceuticals, food supplements, animal feed etc and production of various kinds of biofuels as complementary and/or alternative to petro-fuels; biodiesel from waste cooking oil and micro-algae and bioethanol from macro-algae, different lingo-cellulosic wastes and sugarcane and sugar beet molasses

Introduction

Pectolytic enzymes are involved within the degradation of pectin, a structural component of the center lamella and therefore the voltaic cell walls of plants. Pectins have complex colloidal acidic polysaccharides that demonstrate a backbone of galacturonic acid residues with α -1,4-glycosidic linkages. These molecules possess L-rhamnose, arabinose, galactose, and xylose within the side chains. Also, the carboxylic groups within the galacturonic acid chain are neutralized by different ions, as Na^+ , K^+ , and NH_4^+ . Pectin consists of a family of polysaccharides and oligosaccharides that have common features, but are extremely diverse in their fine structures. However, all pectins are rich in galacturonic acid (GalA) and that they have a minimum of 65% GalA.

Pectinolytic enzymes break down pectin or pectate by the hydrolysis of α -1,4-glycosidic linkages and that they have varied biotechnological applications. The acidophilic pectinases have extensive applications within the manufacture of fruit

juices and wine. They're utilized in fruit juice preparation and clarification, to facilitate pressing and juice extraction. Moreover, pectic enzymes are wont to reduce haze or gelling of fruit juice in wine manufacture and to reinforce the standard of cider apple varieties that are bitter, sweet, or sour. The alkaline pectinase also has various industrial applications, like wastewater treatment, paper manufacturing, oil extraction, coffee and tea fermentation, processing and degumming of the many plant fibers.

Several fungal species are effective degraders of pectic substances, having the ability to supply high amounts of pectinolytic enzymes. a completely unique strain of *A. niveus* was isolated from Brazilian soil, which produces high levels of several hydrolytic enzymes, like xylanase and amylases. During this work, we demonstrated that this fungus also produced high polygalacturonase levels when grown on agricultural wastes, like orange rind and keeness fruit peel. These work results in future biotechnological applications, and it also contributes to diminish the environmental pollution consequent of the buildup of citric residues that are discarded within the environment.

2. Materials and Methods

2.1. Organism and Growth Conditions

Aspergillus niveus was isolated from mango in our laboratory. The microorganism was identified and deposited within the culture collection of Pernambuco Federal University (PE, Brazil). The organism was maintained on slants of potato dextrose agar (PDA) medium covered with oil, at 4°C. The fungus was incubated on PDA medium, at 30°C for 15 days previous to the cultivation and optimization experiments. Then, conidia from these cultures were inoculated into 125-mL Erlenmeyer flasks containing 25 mL of liquid Czapeck medium [9] with 1.0% citric pectin Sigma (w/v) or other carbon sources as described in Results. The cultures were incubated at 40°C, under agitation (100 rpm) or under static conditions, for various periods, counting on the experiment. Other media were wont to standardize the pectinolytic production, like M-5, Adams, Khanna, SR-Segato Rizzatti et al. and Czapeck medium. Cultures were filtered through Whatman no. 1 during a Buchner funnel. The filtrate was saved as a source of crude extracellular

polygalacturonase. Micelial pads were ground with sea sand, at 4°C with ten vol. of cold 100 mM sodium acetate buffer, pH 6.0. After centrifugation (15,000xg, 15 min, 4°C), the supernatant fraction was the source of crude intracellular enzyme.

2.2. Culture Condition under SSF

The fungus was inoculated (conidia/mL) on SSF medium, composed by 2 g of various agro-industrial residues plus 4mL of sterile water. After the time period, the cultures were added of fifty mL of water, maintained on ice and agitated for 30 min, then, the extract fluid was separated from the solid residues as described in Section 2.1, and therefore the filtrate was the source of crude extracellular polygalacturonase.

2.3. Enzymatic Assays and Protein Determination

Polygalacturonase activity was assayed consistent with Miller. The enzymatic assays were administered with 50µL of enzyme and 1.0% polygalacturonic acid sodium salt from Sigma-Aldrich in 100 mM acetate buffer pH 4.0, as substrate. The reactions occurred at 60°C, for 5 min. A unit was defined because the amount of enzyme that releases 1 µmol of reducing

sugar per min under the assay conditions. Protein was assayed consistent with Lowry et al. using bovine albumin because the standard. complete activity and total protein content is represent U/mL or mg/mL multiplied by total volume of culture filtrate.

In conclusion, agro-industrial residues, like orange and lemon rind, induce high levels of a thermo stable acid PG by *A. niveus*. Finally, the utilization of those residues on industrial enzymatic production would aggregate value to waste and would scale back the environmental pollution. Tons of agro-industrial wastes are produced annually all over the world. These wastes aren't economically reused; create air, soil and pollution that has negative impact on human health, tourism, economy and environment. My talk will briefly summarize how these wastes are often applied to unravel many of pollution, waste management, energy etc; problems for example; bioremediation of various oil polluted environments and our successful effort in real field case studies, bio-upgrading of petroleum and its fractions throughout the appliance of bio-desulfurization, bidenitrogenation etc, biosorption and wastewater treatment. Recycling of different kinds of agro-industrial wastes to produce valuable products e.g.- Nanomaterials, bio-surfactants, biocides, catalysts to be applied in biodiesel production, corrosion inhibitors and green catalyst with high photo-catalytic degradation properties