Solid-state fermentation: A strategy for biological detoxification of coffee industry residues

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Coffee is the second largest traded commodity in the world, after petroleum, and therefore, the coffee industry is responsible for the generation of large amount of residues. Among these residues, coffee silverskin (CS) and spent coffee grounds (SCG) are generated in significant amounts and merit special attention. Despite the large generation, most of these residues are unutilized, being discharged to the environment or burned for elimination, which are not environmentally friendly techniques. The discharge to the environment cause severe contamination and environmental pollution problems due to their toxic nature (presence of polyphenols, caffeine, and tannins), and burning results in the production of carbon dioxide, the green house gas. If the toxic constituents present in these materials could be removed, or, at least degraded to a reasonably low level, it would open new opportunities for the utilization of these residues. Therefore, the development of methods to decrease their toxicity or to utilize them as raw material for the production of value added compounds is of great relevance. Solid-state fermentation (SSF) can be defined as the growth of microorganisms on moistened solid substrate, in which enough moisture is present to maintain microbial growth and metabolism, but there is no free-moving water. In recent years, SSF has received more interest from researchers since several studies have demonstrated that this process may lead to higher yields and productivities or better product characteristics than submerged fermentation systems. Based on the above mentioned aspects, the present study consisted in evaluating the ability of seven different fungal strains from the genus Aspergillus, Mucor, Penicillium, and Neurospora, to grow and release phenolic compounds from CS and SCG under solid-state cultivation conditions, as an alternative for biological detoxification of these residues. The biomass production and content of phenolic compounds released from the substrates were monitored during the cultivations. According to the results, Penicillium purpurogenum, Neurospora crassa and Mucor released the highest amount of phenolic compounds from the materials, contributing thus for their detoxification, since phenolic compounds are closely related to the material toxicity. Biological detoxification of CS and SCG provides environmental benefits for the disposal of these residues, as well as economical benefits for the conversion of them to value added products that can be industrially applied. Acknowledgements: NovaDelta - Comércio e Indústria de Cafés, Lda (Campo Maior, Portugal), and FCT (grant SFRH/BPD/38212/2007).

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