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"Gheorghe Asachi" Technical University of Iasi, Romania

EFFECT OF NICKEL CONTAMINATION ON THE GROWTH OF OLEAGINOUS YEASTS IN HYDROLISATES OF *Arundo donax*

Domenico Pirozzi[1*], Giuseppe Toscano[1], Gerardo Caputo[1], Ciro Florio[1], Felicia Rugari[1], Giuseppe Travaglini[1], Abu Yousuf[2], Gaetano Zuccaro[1]

[1]Università Federico II, Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale (DICMAPI), 80 P.le Tecchio, 80125 Napoli, Italy
[2]University Malaysia Pahang, Faculty of Engineering Technology (Program of Energy and Environment), 26300 Gambang, Malaysia

Abstract

Hydrolysates of *Arundo donax*, a crop offering high productivity in contaminated or salinized soils with no inputs of irrigation and agrochemicals, were used in a discontinuous fermenter to grow the oleaginous yeast *Lipomyces starkey*, to obtain microbial oils potentially useful for the production of 2nd-generation biodiesel.
A mixture of fermentable sugars was obtained by steam-explosion and subsequent enzymatic hydrolysis of the lignocellulosic materials. The concentration of Ni^{2+} ions and of inhibitors of the microbial growth significantly affected both the biomass and the triglyceride yields. The microbial lipids produced were compatible with the synthesis of an automotive-grade biodiesel.
A physico-mathematical model, developed to describe the biomass growth, demonstrated that the concentration of heavy metals affected the maximum biomass concentration, though its influence on the specific growth rate of the yeasts was not significant.

Key words: Arundo donax, heavy metals, microbial oils, oleaginous yeasts.

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1. Introduction

The application of the first-generation biodiesel, mainly obtained from vegetable oils or animal fats, is critically limited by the relatively high costs of the feedstocks, that make the biodiesel still more expensive than mineral diesel (Huang et al., 2009; Yu et al., 2011), and by the insufficient availability of fertile land. In addition, the use of edible oils to produce biodiesel is threatening food supplies and biodiversity, causing social and environmental problems in developing countries.

New perspectives are offered by the recent development of new preparations of cellulolytic enzymes, that are able to efficiently hydrolyze lignocellulosic materials (Hendriks and Zeeman, 2009; Jorgensen et al., 2007), such as non-food parts of crops, forest products, and industry wastes, that can be recycled to obtain fermentable sugars. Though so far the hydrolysates of lignocellulose have been mainly used for the production of bioethanol, they can be alternatively employed for culturing oleaginous microorganisms, that are able to produce more than 20% of their weight in the form of lipids (Huang et al., 2012a; Pirozzi et al., 2013; Yu et al., 2011; Zhao et al., 2012). These lipids are mainly triglycerides, potentially exploitable as feedstock for the synthesis of the so-called *2nd generation biodiesel*. Among oleaginous microorganisms, oleaginous yeasts are particularly attractive due to their simpler cultural requirements (aerobic condition and a C/N ratio > 50), as well as to their ability to metabolize low-cost industrial wastes (Angerbauer et al., 2008; Fakas et al., 2008; Papanikolau et al.,

* Author to whom all correspondence should be addressed: email: dpirozzi@unina.it