LIPASE PRODUCTION BY *ASPERGILLUS IBERICUS* USING OIL CAKES AND ITS APPLICATION ON ESTERIFICATION REACTIONS

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Abstract

Large amounts of excess plant biomass are produced by agroindustries. Biotechnological innovations, mainly in the fermentation technology, have opened new areas for utilization of oil cakes as raw materials for the production of value added products. Oil cakes have been used as substrates in solid-state fermentation (SSF) for the enzymes production by filamentous fungi.

This work deals with the optimisation of fermentation conditions which maximise the production of lipase from *Aspergillus ibericus* MUM 03.49 under SSF using different oil cakes from Brazil. Combinations of oil cakes, moisture content (MC) and nitrogen sources were studied. Finally, the obtained lipase was applied in esterification reactions with different carboxylic acids and alcohols.

SSFs were performed in 250 mL containing 15 g of oil cake. After lipase extraction, lipase activity was determined by spectrophotometric method, using *p*-nitrophenyl butyrate as substrate. Esterification reactions were performed in 15 mL falcon tubes with 5 mL volume reaction. Conversion yield was determined by the titration of the residual acid content, using 0.1 M sodium hydroxide.

Lipase production was significantly influenced by the oil cake used. Palm kernel oil cake (PKOC) presented higher lipase production (127 ± 17 U/g), following by sesame oil cake (SOC) (78 ± 2 U/g), after 7 days of SSF. The combination of oil cakes PKOC+SOC led to maximum lipase production of 328 ± 6 U/g. Also, on PKOC+CrOC (crambe oil cake) it was possible to obtain high lipase activity (272 ± 23 U/g). A central composite design was performed to set optimum MC and ratio of PKOC+SOC. A MC of 57% and a ratio of 0.45:0.55 PKOC:SOC were determined predicting a lipase production of 360 U/g. NH_4Cl was found to be the best nitrogen source at concentration of 1% (w/w). From the profile of lipase production over fermentation time, it was observed a continuous enzyme activity increase till the 6th day, reaching 460 ± 38 U/g, corresponding to a productivity of 3.2 ± 0.3 U/(g h); and stabilizing till the end of 20 days, yielding 578 ± 20 U/g.

Finally, the whole fermented cake with lipase was lyophilized and applied in esterification reactions, combining different carboxylic acids with alcohols. A 100% conversion yield was obtained for decanoic acid with butanol using 20% (w/w) lipase. Optimisation process led to the use of 5% lipase in universal buffer at pH 7 or 8, for 24 h at 37 ºC, to obtain butyl decanoate ester.

The biotechnological valorisation of SSF combining oil cakes is an interesting strategy to produce considerable amounts of lipase. Further, lipase produced may be applied to produce butyl decanoate ester, a natural flavor with interest for food industry.