Enhancement of β-mannanase production by Bacillus subtilis ATCC11774 through optimization of medium composition

ABSTRACT

Palm kernel cake (PKC) has been largely produced in Malaysia as one of the cheap and abundant agro-waste by-products from the palm oil industry and it contains high fiber (mannan) content. The present study aimed to produce β-mannanase by Bacillus subtilis ATCC11774 via optimization of the medium composition using palm kernel cake as substrate in semi-solid fermentation. The fermentation nutrients such as PKC, peptone, yeast extract, sodium chloride, magnesium sulphate (MgSO2), initial culture pH and temperature were screened using a PlackettBurman design. The three most significant factors identified, PKC, peptone and NaCl, were further optimized using central composite design (CCD), a response surface methodology (RSM) approach, where yeast extract and MgSO2 were fixed as a constant factor. The maximum βmannanase activity predicted by CCD under the optimum medium composition of 16.50 g/L PKC, 19.59 g/L peptone, 3.00 g/L yeast extract, 2.72 g/L NaCl and 0.2 g/L MgSO2 was 799 U/mL. The validated β-mannanase activity was 805.12 U/mL, which was close to the predicted β-mannanas activity. As a comparison, commercial media such as nutrient broth, M9 and Luria bertani were used for the production of β-mannanase with activities achieved at 204.16 ± 9.21 U/mL, 50.32 U/mL and 88.90 U/mL, respectively. The optimized PKC fermentation medium was four times higher than nutrient broth. Hence, it could be a potential fermentation substrate for the production of β-mannanase activity by Bacillus subtilis ATCC11774.

Keyword: β-mannanase; Bacillus subtilis; Palm kernel cake; Optimization; Response surface methodology