

Effective production of keratinase by gellan gum-immobilised *Alcaligenes* sp. AQ05-001 using heavy metal-free and polluted feather wastes as substrates

ABSTRACT

The ability of gellan gum-immobilised cells of the heavy metal-tolerant bacterium *Alcaligenes* sp. AQ05-001 to utilise both heavy metal-free and heavy metal-polluted feathers (HMPFs) as substrates to produce keratinase enzyme was studied. Optimisation of the media pH, incubation temperature and immobilisation parameters (bead size, bead number, gellan gum concentration) was determined for the best possible production of keratinase using the one-factor-at-a-time technique. The results showed that the immobilised cells could tolerate a broader range of heavy metal concentrations and produced higher keratinase activity at a gellan gum concentration of 0.8% (w/v), a bead size of 3 mm, bead number of 250, pH of 8 and temperature of 30 °C. The entrapped bacterium was used repeatedly for ten cycles to produce keratinase using feathers polluted with 25 ppm of Co, Cu and Ag as substrates without the need for desorption. However, its inability to tolerate/utilise feathers polluted with Hg, Pb, and Zn above 5 ppm, and Ag and Cd above 10 ppm resulted in a considerable decrease in keratinase production. Furthermore, the immobilised cells could retain approximately 95% of their keratinase production capacity when 5 ppm of Co, Cu, and Ag, and 10 ppm of As and Cd were used to pollute feathers. When the feathers containing a mixture of Ag, Co, and Cu at 25 ppm each and Hg, Ni, Pb, and Zn at 5 ppm each were used as substrates, the immobilised cells maintained their operational stability and biological activity (keratinase production) at the end of 3rd and 4th cycles, respectively. The study indicates that HMPF can be effectively utilised as a substrate by the immobilised-cell system of *Alcaligenes* sp. AQ05-001 for the semi-continuous production of keratinase enzyme.

Keyword: Immobilisation; Gellan gum; *Alcaligenes* sp.; Feather degradation; Heavy metals

