

## **Novel Matrix for Biocatalyst Production**

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Industrially, biocatalysts using immobilised enzymes are preferable to free enzymes since they can be easily separated from the reaction mixture and can be reused. In the field of material sciences, k-carrageenan gel, an environmental friendly polysaccharide is well known for the immobilisation of cells and in some cases enzymes for bio-catalysis, bio-remediation, bio-improvements, bio-separations and treatment of wastes. However, the principal drawback of unmodified carrageenan is its poor mechanical and thermal stability. For this reason, immobilisation using carrageenan gel has been mainly limited to entrapment methods. In this work, a thermally and mechanically stable generic catalytic matrix was produced from k-carrageenan gel to covalently immobilise enzymes. The modified gel remained stable in different buffers at 70 oC for 24 h and its mechanical strength was 400 % greater than the unmodified gel. Eight commercial enzymes such as penicillin G acylase, horseradish peroxidase, lipase, D-amino acid oxidase, glucose oxidase, lactate dehydrogenase, trypsin and formate dehydrogenase were immobilised successfully.

The new polymeric matrix proved to be effective as a universal support for enzyme immobilisations. Penicillin G acylase was chosen as a model enzyme to optimise immobilisation conditions and it was possible to achieve retention of 44.1 % of enzyme starting activity with no leakage of enzyme from the gel matrix. The modified gel also improved the thermal stability of PGA substantially. Whilst free PGA retained 2.5 % activity at 85 oC for 5 min, immobilised PGA retained 70 % of its activity. The traditional method of pouring warm gel in a container to produce gel sheets, disks and cubes for immobilisation and mechanical strength examination, has been modified by a more efficient parallel plates technique. During measurement of immobilised enzyme activity, some enzymes may leak into the supernatant, and to monitor them, a simple protocol was invented. Finally, in economic terms, the preparation of the modified gel costs only approximately £ 15 per kg (at current prices) compared to commercially available matrices such as Eupergit-C, which retail at approximately £5000 per kg (July 2004).