Bioencapsulation Research Group

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bead only the two immobilized microorganisms (*Chlorella* and *Azospirillum*) are detected (Fig. 2).

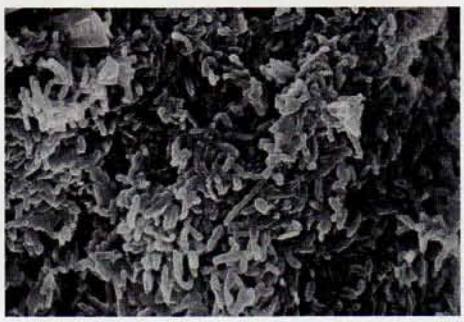

Figure 1. View of the periphery of the bead, covered by microorganisms.

Figure 2. View of the interior of the bead, where only *Chlorella* spp. (red arrow) and *A. brasilense* (white arrow) are present.

After 48 hours of the beads being immerse in the wastewater, its stability declines (Fig. 3), as a result of a dense biofilm composed of wastewater bacteria and *A. brasilense* was created on the surface of the beads.

However, although beads lost their mechanical strength after 48 h of incubation their shape-integrity lasted for at least 96 h. This sustains tertiary successful wastewater treatment within 48 h.

Tertiary wastewater treatment in 25 L triangular, airlift, autotrophic bioreactors showed >90% of PO_4^{-3} and >50% of ammonium were removed. The decline in bead strength phenomena as in small bioreactors. Total bacteria during the wastewater treatment increased only in the presence of the immobilized treatment agents.

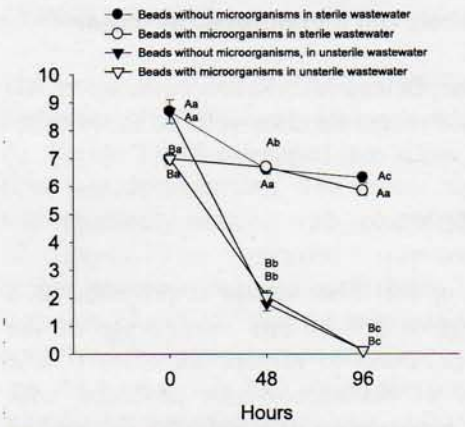

Figure 3. Reduction of gel strength of the bead during incubation of 96 hours in wastewater. Points on each curve denoted by a different letter differ significantly at $P < 0.05$ in one-way ANOVA.

CONCLUSIONS

This study demonstrates that partial biological degradation of alginate beads occurred during tertiary wastewater treatment but the beads survive long enough to permit efficient nutrient removal. The wastewater natural microbial populations are responsible for decreasing populations of microbial agents used for wastewater treatment and immobilization in alginate beads provided a protective environment for these agents to carry out uninterrupted tertiary wastewater treatment.

REFERENCES

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