Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.

Polyethylene glycol as a robust, biocompatible encapsulant for two-stage treatment of food and beverage wastewater

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Supporting Information

Methodology

Table S1. *Formulation of high-strength synthetic wastewater in DI water*[1]

Reagent	Concentration (g/L)
Polysorbate	0.96
Gelatin	3.75
Starch	1.75
Casamino acids	0.08
Yeast extract	0.08
Ammonium chloride	0.15
Sodium bicarbonate	0.10
Sodium phosphate	0.03
Potassium phosphate	0.03
Magnesium chloride	0.04
Calcium chloride	0.06

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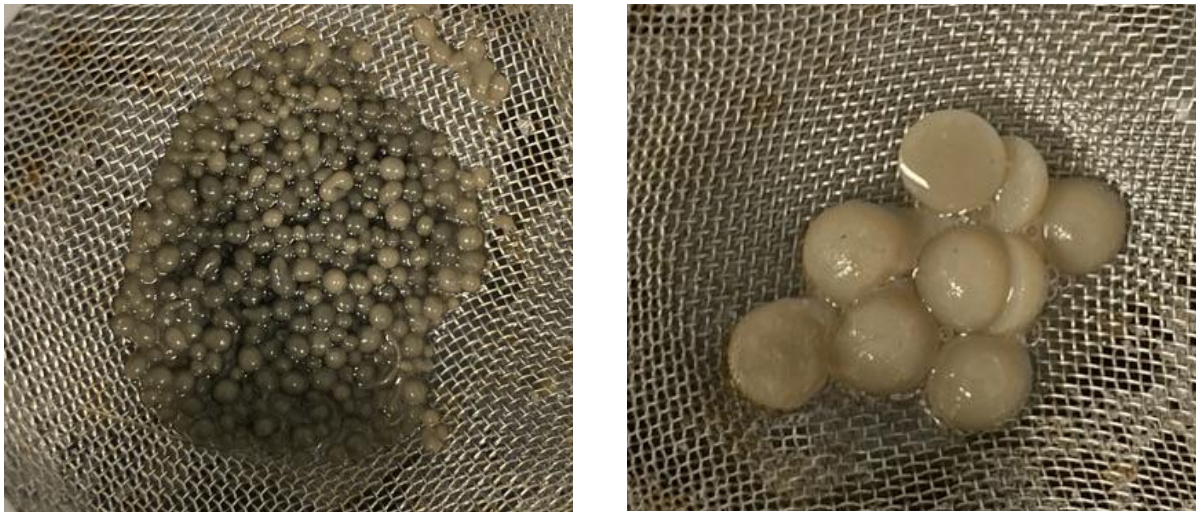

(a) (b)

17 ***Figure S1.*** *Alginate beads (a) and PEG beads (b) containing fermentative bacteria were approximately 2*
18 *mm and 10 mm in diameter, respectively.*

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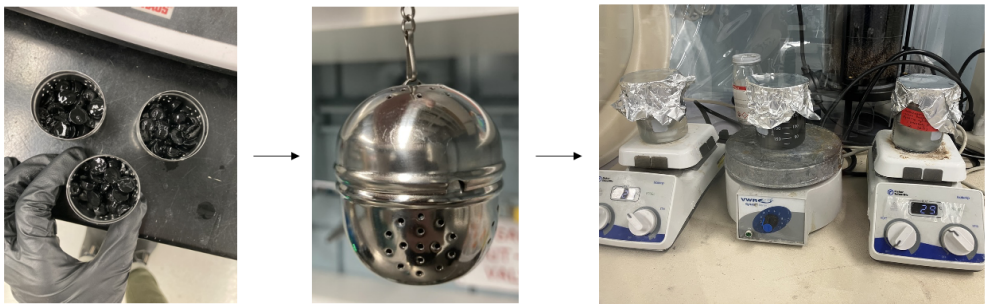
a

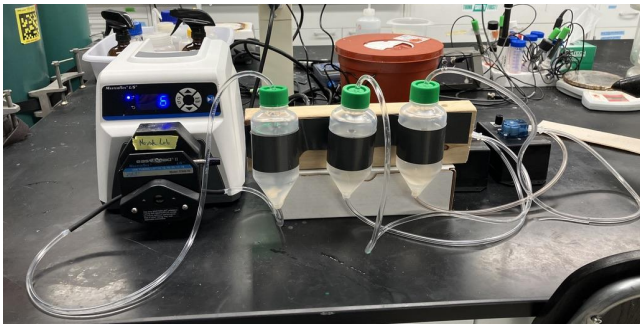
b

Figure S2. *Photos of (a) the three-stage system of reactors used to assess bead integrity, with a close-up (b) of alginate beads in the 7-mL flow-through reactor. Data collection from the first and third stages included intact bead count, encapsulated biomass concentration as protein, and gas production.*

(a)



(b)



(c)

(d)

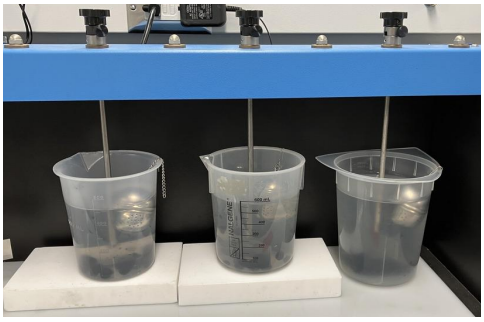


Figure S3. *Caged (a) and upflow (b) second-stage reactors were used to assess the impact of reactor conditions on the longevity of PEG beads encapsulating PAC-supported biofilms in a three-stage experimental set-up. Stirred (c) and impeller (d) reactor experiments were also performed with PEG beads encapsulating PAC-supported biofilms. Note: the tea balls shown in panel d were not filled with*

encapsulated organisms; they were simply placed in the jar tester to determine if this set-up would work in future experiments.

Results and Discussion

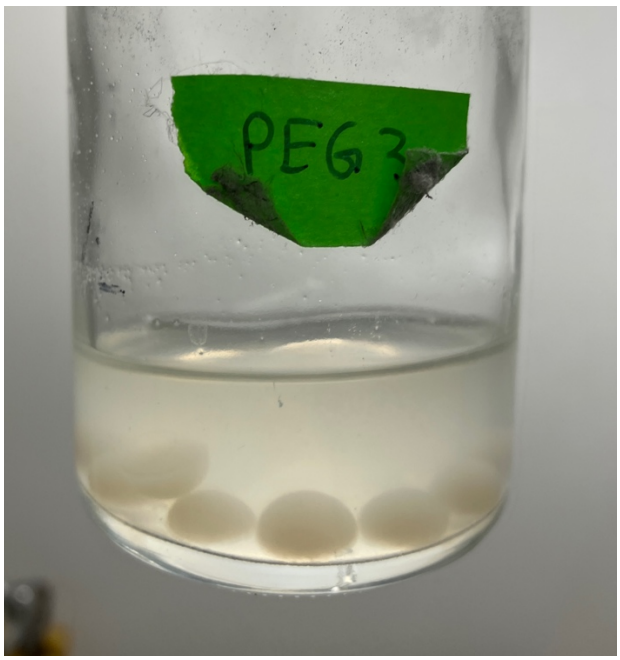
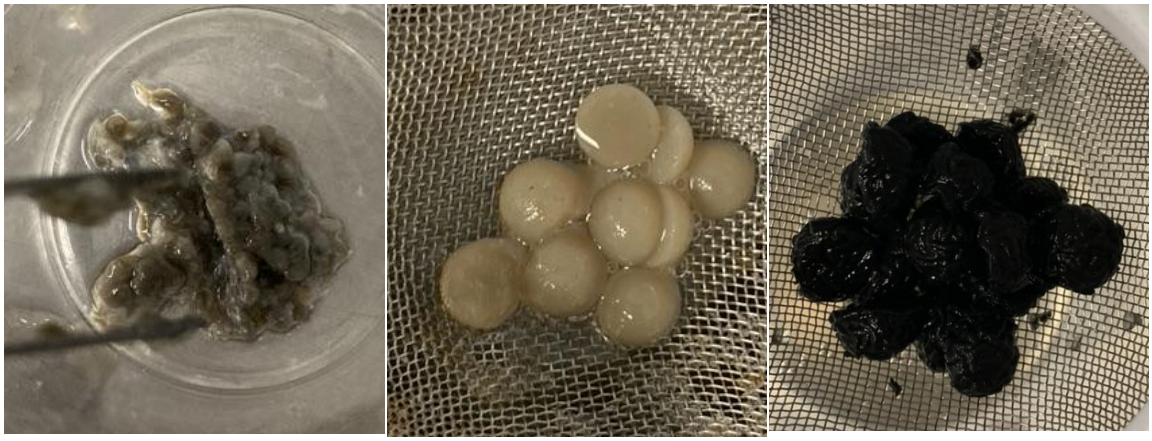


Figure S4. *After 10 months in shaken batch reactors, PEG beads have retained their shape and show no physical signs of deterioration.*



(a) (b) (c)

Figure S5. *Alginate beads (a), PEG beads encapsulating suspended biomass (b), and PEG beads encapsulating PAC-supported biofilms (c) after one month of operation in the three-stage reactor set-up, photographed after the third stage.*

(a) (b)

Figure S6. *After two weeks in a stirred reactor with heat, PEG beads encapsulating PAC-supported biofilms completely disintegrated (a), while after two weeks in an impeller-stirred reactor, PEG beads encapsulating PAC-supported biofilms broke into small pieces (b). Note: the tea ball shown in panel b*

was not filled with encapsulated organisms; it was simply placed in the jar tester to determine if this set-up would work in future experiments.

References

1. K. Zhu, C. W. Davis, P. J. Novak and W. A. Arnold, *Bioresource Technology Reports*, 2020, **11**, 100451.