Studies on the structure-property relationship of sodium alginate based thixotropic hydrogels

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Fig. S1 Variation of the theoretical uronic acid activation by altering the concentration of EDC/NHS added to the reaction medium
Fig. S2 Effect of molar concentration of 1-Naphthylamine on the yield of Alg-Naph conjugate
Fig. S3. Thixotropic loops for Na-Alg-Naph for 09 subsequent cycles.
**Fig. S4.** Time dependent thixotropicity of Na-Alg-Naph and Na-Alginate at 4 % w/v concentration, change in viscosity with the time at different shear rate.
Table S5. Viscosity data of Na-Alg, Na-Alg-Aniline, Na-Alg- Naph & Na-Alg-Anthracene amide derivatives

<table>
<thead>
<tr>
<th>Sample</th>
<th>Apparent viscosity in (Pa.s) at conc. (2% w/v)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na-Alg</td>
<td>0.09± 0.05 a</td>
</tr>
<tr>
<td>Na-Alg-Aniline amide</td>
<td>0.004± 0.05 a</td>
</tr>
<tr>
<td>Na-Alg-Naph amide (1:0.5)</td>
<td>0.37± 0.05 a</td>
</tr>
<tr>
<td>Na-Alg-Anthracene amide</td>
<td>0.024± 0.05 a</td>
</tr>
</tbody>
</table>

*aApparent viscosity measured at 20 RPM and at room temperature

Fig. S6 FT-IR spectra of Na-alginate, aniline and alg-aniline amide derivative
Fig. S7 $^{13}$C NMR spectra of Alg-Aniline amide derivative
Fig.S8 FT-IR spectra of Na-alginate, 2-Amino anthracene and alg-anthracene amide
Fig. S9 $^{13}$C NMR spectra of Alg-Anthracene amide derivative
Fig. S10 Thixotropic loops for Na-Alg-Anthracene amide for 03 subsequent cycles.
Creep recovery measurements

Fig. S5 provides a diagram of the output response from a creep and recovery experiment which is the compliance (J) as a function of time and the compliance of the sample is initially overcome by the elastic component, followed by the viscoelastic component, then finally the viscous component where continuous flow occurs. In the recovery experiment, the extent of the recovery gives an indication of the thixotropic property of the samples Alg-Naph. The extent of recovery (R%) was calculated using equation No (SE1) was described by (ez-Sales et al. 2007 and Phair et al. 2009).¹,²

\[ R \% = \frac{J_e}{J_{max}} \times 100 \]  \hspace{1cm} (SE1)

Where, \( J_e \) is the elastic recoverable compliance which is the difference between the compliance at the end of the creep (\( t = t_2 \)) and recovery experiment (\( t = t_3 \)) (Fig. S5).

A characteristic relaxation time (\( t_r \)) may also yield a quantitative assessment of the thixotropy and which was calculated using equation No (SE2).²

\[ t_r = \eta_0 \times J_e \]  \hspace{1cm} (SE2)

Where, \( \eta_0 \) is the zero shear viscosity which was determined by the slope of the line of the viscous regime of the creep curve.

Fig. S11  Visual discription of creep and recovery
References