**HIGH TEMPERATURE GELLING AGENT FOR OIL AND GAS APPLICATIONS**

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**PRODUCT BACKGROUND**

- Utilization of viscous fluid in a wellbore have been a common practice to enhance oil and gas hydrocarbons production.  
- The viscous fluids are usually produced by hydrating common gelling agent such as hydroxyethyl cellulose, guar gum and xanthan gum in water or aqueous solution.  
- As the oil exploration shifted towards higher-temperature reservoir, the common gelling agents are no longer usable because of degradation upon exposed to high temperature.  
- To overcome this problem, UMP in collaboration with Neu Solutions Sdn Bhd have produced high-temperature gelling agent (HT-GA)  
- HT-GA price is 75% cheaper compared to high temperature gelling agent in the market

**BENEFITS AND APPLICATIONS**

- Produced from natural sources polymer, environmentally friendly.  
- Thermal stability up to 350°F.  
- High viscosity at low polymer loading.  
- Excellent suspension capabilities  
- Easily mixed in freshwater, seawater or monovalent brines.

**APPLICATIONS**

- Polymer flooding for enhance oil recovery (EOR)  
- Hydraulic fracturing  
- Wellbore cleanout operation

**PRODUCTION PROCESS**

- Biopolymer modification  
- Product washing  
- Product drying  
- Product mixing  
- HT-GA gelling fluid

**PRODUCT CHARACTERISTICS**

- FTIR spectrum of Gelling Agent (GA) and High Temperature-Gelling Agent (HT-GA)  
- Viscosity of GA and HT-GA at different concentrations  
- Temperature influence on the rheological properties of GA and HT-GA

**MARKETABILITY & PRICE ESTIMATION**

- Global gelling agent market is expected to grow significantly from USD 9.79B in 2016, to USD 13.91B in 2023.

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Temperature (°F)</th>
<th>Field Conc (lb/bbl)</th>
<th>Est. cost per bbl (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>325</td>
<td>1.7</td>
<td>340.00</td>
</tr>
<tr>
<td>HT-GA</td>
<td>325</td>
<td>1.7</td>
<td>90.00</td>
</tr>
<tr>
<td>GA</td>
<td>270</td>
<td>1.7</td>
<td>80.00</td>
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<tr>
<td>Xanthan</td>
<td>250</td>
<td>2.5</td>
<td>31.50</td>
</tr>
<tr>
<td>HEC</td>
<td>200</td>
<td>2.5</td>
<td>31.50</td>
</tr>
</tbody>
</table>

**TECHNOLOGY READINESS LEVELS (TRLs)**

- TRL 1: Concept design and conceptual development
- TRL 2: Feasibility study and prototype development
- TRL 3: Laboratory-scale demonstration
- TRL 4: Field demonstration in a laboratory environment
- TRL 5: Pilot plant or demonstration in a subscale field environment
- TRL 6: Demonstration in a full-scale field environment
- TRL 7: Commercial and experimental field demonstration
- TRL 8: Commercial and experimental field demonstration
- TRL 9: Commercial readiness