# Bio–Based Oligomer Technology


Bio–based oligomers are wholly or partly derived from renewable raw materials such as plants or crops. Not only do they mitigate the supply chain risk of relying on petroleum–based products, as also do they offer other advantages such as lower irritation and toxicity or the possibility to formulate products with innovative characteristics. Over the past few years, stricter regulations around product safety and growing consumer awareness are shifting towards products made from bio–based sources.

In addition to market trends increasing the desirability of bio–based feedstocks, growing environmental and health concerns within certain markets have resulted in constraints on tin–based metal catalysts that have been used for urethane systems for over 50 years. Regulatory organizations, such as ECHA (European Chemical Agency), have restricted the use of certain organotin catalysts in cosmetic applications, while other agencies and industrial markets have suggested concentration restrictions of such chemicals. As the world focuses on safer and greener chemistries, the reduction of organotin catalysts and the development of oligomers that contain bio–sourced raw materials are highly desired.

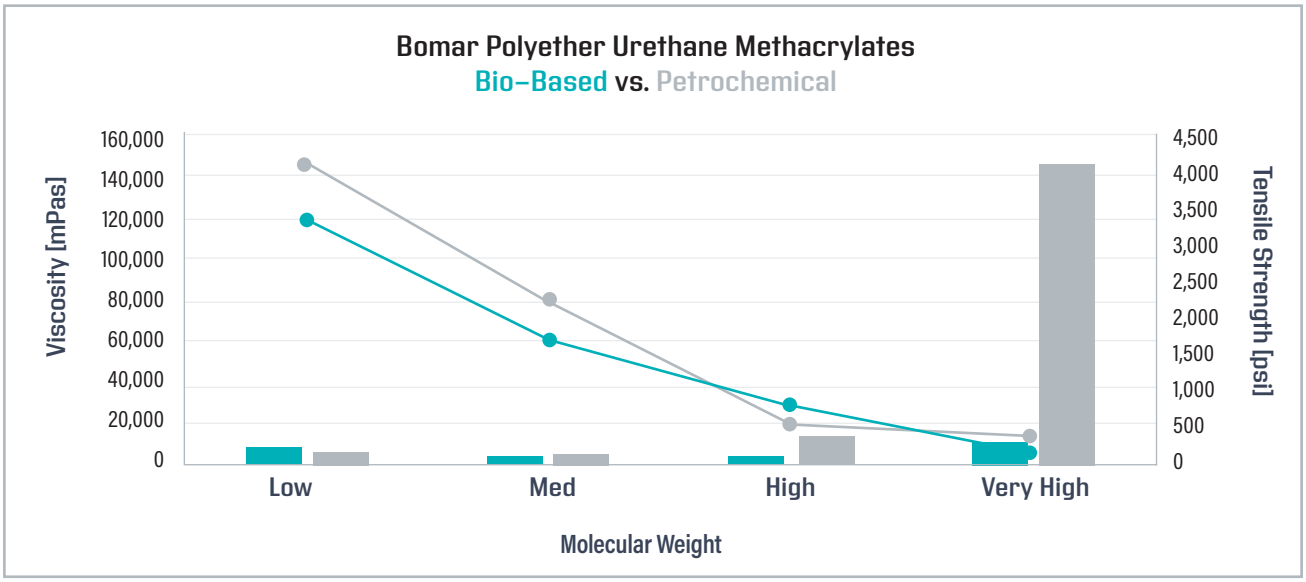
## Bio–Based Oligomers for Environmentally Sustainable Formulations

Bomar has developed a range of bio–based polyether urethane methacrylate products with significant bio–content, formulated with a tin–free catalyst, which in addition with the methacrylate functionality make these excellent candidates for consumer applications with low irritancy requirements. Compared to traditional bio–based products, Bomar BR–104xMB oligomers show very low coloring and are therefore ideal to use in applications where yellowing is critical.

Especially the latest addition to this product range – BR–1044MB – with its bio–content of >80%, offers a significantly reduced viscosity compared to its petrochemical analog.

### Features

- High bio–based content
- Tin–free catalyst
- Low color / low yellowing
- Low temperature flexibility
- High rebound
- Excellent elasticity
- Excellent mechanical properties to meet improved performance requirements
- Reduced / Lower MeHQ content to meet latest cosmetic guidelines




Comparison of viscosity (neat – bar chart) and tensile strength (30% IBOA dilution – line graph) for Bomar bio–based and standard petrochemical oligomers depending on their molecular weights

Overall, the mechanical properties of these Bomar bio–based oligomers are very similar, if not better, compared to corresponding petro–based products. They also show excellent low–temperature flexibility, elasticity, and excellent dynamic properties and rebound with a lower viscosity versus similar polyether chemistries. These oligomers provide a higher degree of heat resistance to the cured formulation vs other polyether oligomers and contribute excellent properties to nail coatings, 3D printing resins, and impact resistant coatings.

Unlike common bio–based materials, these innovative Bomar oligomers from renewable raw materials exhibit very low initial color, which makes them ideal for both transparent and pigmented coatings. With their low MeHQ content this range also meets the latest cosmetic guidelines for inhibitor concentration.

### Application Areas

- Nail coatings
- Impact–resistant coatings
- Flexible / tough 3D printing resins

| | | BR-1041MB | BR-1042MB | BR-1043MB | BR-1044MB | BR-541MB | BR-543MB | BR-544MB** |
|---|---|---|---|---|---|---|---|---|
| | Molecular Weight | Low | Medium | High | Very High | Low | High | Very High |
| | Bio-Based Carbon (ASTM D6866) | 45% | 59% | 75% | 84% | 0% | 0% | 0% |
| | Tin-Free | Yes | Yes | No** | Yes | No* | No | No |
| **Neat (Undiluted)** | Viscosity [cP @60°C] | 8,900 | 4,000 | 5,100 | 12,000 | 6,500 | 14,000 | 144,000 |
| | Color (APHA) | 43 | 53 | 40 | 70 | 17 | 20 | 40 |
| | Tg [°C] | 89 | 45 | 19 | -48 | 60 | -55 | -7 |
| | HDT [°C] | 73 | 24 | -52 | -66 | 50 | -46 | -41 |
| | IZOD Impact Strength [J/m] | 115 | No Break | No Break | No Break | 125 | No Break | No Break |
| **30% IBOA Dilution** | Viscosity [cP @25°C] | 8,900 | 4,800 | 6,700 | 10,500 | 7,400 | 15,000 | 89,250 |
| | Tensile at Break [MPa / psi] | 23 / 3,300 | 12 / 1,700 | 6 / 800 | 2 / 230 | 28 / 4,100 | 4 / 600 | 3 / 400 |
| | Elongation at Break [%] | 35 | 75 | 130 | 119 | 85 | 110 | 290 |
| | Young's Modulus [MPA / ksi] | 1,100 / 160 | 76 / 11 | 9 / 1.3 | 2.8 / 0.4 | 570 / 83 | 7.6 / 1.1 | 2.8 /0.4 |
| | Hardness (Shore Durometer) | 80D | 58D | 22D | 55A | 74D | 16D | 43A |
| | Solvent Resistance (MEK Double Rubs) | 186 | 61 | 41 | 22 | 73 | 5 | 60 |

*Tin-free formula in development **Commercially not available / for comparison only

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