AMBERLITE™ IRP88
Pharmaceutical Grade Cation Exchange Resin
(Polacrilin Potassium NF)

Description
AMBERLITE™ IRP88\(^{[1]}\) resin is a weakly acidic potassium form cation exchange resin supplied as a dry powder. It can be used as a tablet disintegrant in oral dosage formulations of drug products. AMBERLITE IRP88 is the potassium salt of a crosslinked polymer derived from methacrylic acid. Its swelling properties upon hydration provide its utility as a tablet disintegrant. AMBERLITE IRP88 has been proposed for use in taste masking applications, specifically for B-lactam antibiotics.

\(^{[1]}\) The use of AMBERLITE pharmaceutical grade ion exchange resins as components of drug formulations is subject to the U.S. Food, Drug, and Cosmetic Act as amended.

Typical Physical and Chemical Properties
AMBERLITE IRP88 complies with the compendial specifications for Polacrilin Potassium NF when tested in conformance to the compendial test methods presented in current USP/NF. These compendial properties are shown below. A Drug Master File (“DMF”) for this product is maintained with the United States Food and Drug Administration.

Table 1. Typical Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity (by IR Spectrum)</td>
<td>Identical to USP reference standard</td>
</tr>
<tr>
<td>Loss on drying (^{[1]})</td>
<td>10.0% maximum</td>
</tr>
<tr>
<td>Powder fineness</td>
<td></td>
</tr>
<tr>
<td>0.075–0.150 mm (^{[1]})</td>
<td>30.0% maximum</td>
</tr>
<tr>
<td>&gt; 0.150 mm (^{[1]})</td>
<td>1.0% maximum</td>
</tr>
<tr>
<td>Iron (^{[1]})</td>
<td>100 ppm maximum</td>
</tr>
<tr>
<td>Sodium (^{[1]})</td>
<td>0.20% maximum</td>
</tr>
<tr>
<td>Heavy metals (^{[1]})</td>
<td>0.002% maximum</td>
</tr>
<tr>
<td>Potassium (^{[1]})</td>
<td>20.6%–25.1%</td>
</tr>
<tr>
<td>Residual Methacrylic acid (^{[1]})</td>
<td>200 ppm max.</td>
</tr>
<tr>
<td>Organic volatile impurities &lt;467&gt; (^{[1]})</td>
<td>Meets standard specifications</td>
</tr>
</tbody>
</table>

\(^{[1]}\) Appears in current USP/NF

Letters of authorization to the U.S. FDA granting limited access to the DMF in support of NDA (New Drug Application) and ANDA (Abbreviated New drug Application) submittals may be provided upon written request. Similar help may also be offered in support of the registration of formulations containing AMBERLITE IRP88 in many other countries worldwide. AMBERLITE IRP88 is manufactured in accordance with Good Manufacturing Practices (cGMP) for bulk pharmaceutical chemicals.
**Identification**

AMBERLITE™ IRP88 can be identified by infrared spectroscopy, as shown in the example in Figure 1.

**Figure 1. AMBERLITE IRP88 Resin IR Spectrum**

![AMBERLITE IRP88 Resin IR Spectrum](image)

**Chemical Properties**

AMBERLITE™ IRP88 is a crosslinked polymer of methacrylic acid and divinylbenzene, supplied as the potassium salt (CAS 39394-76-5). The structure is shown in Figure 2.

**Figure 2. AMBERLITE IRP88 Resin Chemical Structure**

![AMBERLITE IRP88 Resin Chemical Structure](image)

**Applications**

**Tablet Disintegrant**

Many drugs are supplied as tablets for oral administration. In some cases, the effectiveness of the drug depends on the rate at which the tablet disintegrates in the gastrointestinal tract. AMBERLITE IRP88 is an effective tablet disintegrant due to its extremely large swelling capacity in aqueous solutions. Water can exert force between particles within tablet pores, but this force is relatively low. In the presence of AMBERLITE IRP88 these forces are enhanced, resulting in rapid tablet disintegration. AMBERLITE IRP88 can be used effectively at 1–2 % (weight) of a typical solid dosage formulation.

**Water Adsorption**

AMBERLITE IRP88 adsorbs water rapidly due to its hydrophilic nature. Upon hydration, the resin particles swell. When incorporated into a tablet, the swelling of AMBERLITE IRP88 exhibits sufficient force to rupture and disintegrate even those tablets which have been subjected to very high compression force in the tableting process.
Disintegration times for tablets based upon a matrix of calcium-phosphate-carbonate-complex at various concentrations of some disintegrants are presented in Table 3. These data are presented graphically in Fig. 3. The exceptional rate at which AMBERLITE IRP88 adsorbs water when exposed to high humidity air, as compared to other disintegrants, is presented in Fig. 4.

**Adhesion**
The bonding of particles in compressed tablets must be overcome in order for a tablet to disintegrate, thereby releasing the drug for bioavailability. Some disintegrants are adhesive in nature, and are thus ineffective in overcoming particle bonding. This deficiency is particularly associated with cellulosic materials. Sodium carboxymethyl cellulose and calcium sodium alginate are not effective in overcoming this bonding due to their adhesive nature. AMBERLITE IRP88 is nonadhesive and is frequently much more effective as a disintegrant in such formulations.

**Tablet Hardness**
Hardness is an important factor which prevents the tablets from dusting or breaking up during packaging and shipping. Increasing the compressive force to reduce dusting can frequently retard the rate of subsequent disintegration. Table 2 presents data which shows that increasing the compressive force in the formation of tablets containing 2% by weight AMBERLITE IRP88 enhances the disintegration rate of the tablet.

### Table 2. Effects of increasing pressure on disintegration time of dicalcium phosphate dihydrate tablet with 2% AMBERLITE™ IRP88 Resin

<table>
<thead>
<tr>
<th>Tablet Pressure Increase from 1–4</th>
<th>Tablet Hardness (Erweka)</th>
<th>Disintegration Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>1.5</td>
<td>120</td>
</tr>
<tr>
<td>P2</td>
<td>7.0</td>
<td>15</td>
</tr>
<tr>
<td>P3</td>
<td>9.0</td>
<td>10</td>
</tr>
<tr>
<td>P4</td>
<td>9.5</td>
<td>8</td>
</tr>
</tbody>
</table>

**Figure 3. The effect of disintegrant concentration on the disintegration times of tablets prepared from calcium phosphate carbonate complex**

- AMBERLITE™ IRP88 Resin
- Alginic acid
- Sodium carboxymethylcellulose
- Calcium sodium alginate
Figure 4. The rate of water absorption of disintegrant powders at 25°C and 98% humidity

1) AMBERLITE™ IRP88 Resin
2) Sodium carboxymethycellulose
3) Calcium sodium alginate
4) Alginic acid
5) Cornstarch

Table 3. Effects of Concentration of Disintegrants on the Disintegration Time of a Calcium-Phosphate-Carbonate-Complex Tablet

<table>
<thead>
<tr>
<th>Disintegrant</th>
<th>Amount of Disintegrant in Tablet (%)</th>
<th>Tablet Hardness (Monsanto)</th>
<th>Disintegration Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornstarch</td>
<td>5, 10, 15, 20</td>
<td>3.0, 3.0, 3.0, 3.0</td>
<td>&gt;120, &gt;120, &gt;120, &gt;120</td>
</tr>
<tr>
<td>Calcium sodium alginate</td>
<td>5, 10, 15, 20</td>
<td>4.0, 3.5, 3.5, 2.5</td>
<td>67, 60, 45, 42</td>
</tr>
<tr>
<td>Sodium Carboxymethyl Cellulose</td>
<td>5, 10, 15, 20</td>
<td>4.5, 4.5, 5.0, 3.0</td>
<td>70, 54, 42, 37</td>
</tr>
<tr>
<td>Alginic acid</td>
<td>5, 10, 15, 20</td>
<td>4.6, 3.8, 3.8, 3.5</td>
<td>13, 5, 5, 3</td>
</tr>
<tr>
<td>AMBERLITE™ IRP88</td>
<td>5, 10, 15, 20</td>
<td>4.0, 4.0, 4.0, 4.0</td>
<td>7.5, 5, 3.3, 2</td>
</tr>
</tbody>
</table>
Applications
Reference List

Tablet Disintegrant


Taste Masking


Leonard, Graham Stanley; Cooper, David; Oral liquid compositions containing paroxetine-Amberlite IRP88 complex; SmithKline Beecham PLC, UK; US5811436, 1996.
Safe Handling Information

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

Warning: Oxidizing agents such as nitric acid attack organic ion exchange resins under certain conditions. This could lead to anything from slight resin degradation to a violent exothermic reaction (explosion). Before using strong oxidizing agents, consult sources knowledgeable in handling such materials.

DOW™ Ion Exchange Resins

For more information about DOW™ resins, call the Dow Water & Process Solutions business:
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