Since 1953, JMC has been recognized as the best quality Saccharin producer in the world. JMC has used 65 years of accumulated technological expertise and a skilled workforce to become today’s global market leader.

JMC Saccharin is the world’s highest quality Saccharin available today. Using the traditional Remsen & Fahlberg Process, JMC is the only company that produces all the high purity raw-materials, including the OTSA, from its own production lines. This in-house, vertically-integrated production ensures the highest purity products which leads to the highest quality Saccharin.

The perfect harmony between tradition and technology: this is JMC Saccharin.
Did you know that Saccharin has been a part of our daily lives for more than 100 years?

Saccharin, unlike sugar, has no effect on blood sugar levels and has zero calories. It is therefore considered an important sugar substitute to help combat diabetes and obesity. Furthermore, while it is well-known that sugar produces cavities, Saccharin does not produce any of the acid that results in cavities.

The benefits of Saccharin, which aids diet, diabetes control and cavity prevention, can be realized without giving up the happiness derived from its sweetness.

Saccharin is Healthy

Diabetic patients can safely consume Saccharin because its Glycemic Index (GI) is zero.

Obesity is not a concern because it also has zero calories.
Saccharin is 350 to 500 times sweeter than sugar and costs only 1/40 the price of sugar and 1/8 the price of aspartame for the same level of sweetness. It can be called 'The Dream Sweetener' in terms of sweetness and economical feasibility as well as health. The sweetness equivalency costs are below.

$1.00/kg Saccharin will provide as much sweetness as:

<table>
<thead>
<tr>
<th>Sweetener</th>
<th>Cost/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>$40</td>
</tr>
<tr>
<td>Aspartame</td>
<td>$5.6/kg</td>
</tr>
<tr>
<td>Acesulfame-K</td>
<td>$4.8/kg</td>
</tr>
<tr>
<td>Sacralose</td>
<td>$5.4/kg</td>
</tr>
<tr>
<td>Stevia</td>
<td>$8.9/kg</td>
</tr>
</tbody>
</table>

Saccharin is excellent because of its strength and safety. It can be preserved for a long period of time without decomposition and can act as an effective stabilizer. Moreover, this 'Dream Sweetener' is heat stable. Under conditions of increasing heat, Saccharin remained stable at temperatures up to at least 250°C. By comparison, aspartame started to decompose at 150°C and was completely decomposed at 180°C.

These results demonstrate that aspartame is not appropriate as a sweetener for high temperature usage in food such as baked goods.

### Thermal Resistance Comparison Between Saccharin and Aspartame

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Saccharin</th>
<th>Aspartame</th>
</tr>
</thead>
<tbody>
<tr>
<td>100°C</td>
<td>99%</td>
<td>95%</td>
</tr>
<tr>
<td>150°C</td>
<td>98%</td>
<td>91%</td>
</tr>
<tr>
<td>160°C</td>
<td>97%</td>
<td>82%</td>
</tr>
<tr>
<td>170°C</td>
<td>98%</td>
<td>9%</td>
</tr>
<tr>
<td>180°C</td>
<td>98%</td>
<td>1%</td>
</tr>
<tr>
<td>190°C</td>
<td>95%</td>
<td>1%</td>
</tr>
<tr>
<td>200°C</td>
<td>95%</td>
<td>1%</td>
</tr>
<tr>
<td>250°C</td>
<td>96%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Saccharin is safe due to its long history of use and extensive scientific research. It has been studied by many scientists for 30 years and has been confirmed as a safe artificial sweetener by various international agencies. Saccharin is currently being used in around 100 countries as a food additive without any adverse effects.

**Saccharin Makes A Comeback**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>WHO confirmed as a safe artificial sweetener for human consumption</td>
</tr>
<tr>
<td>1998</td>
<td>IARC deleted from list of carcinogens</td>
</tr>
<tr>
<td>2000</td>
<td>FDA declared safe for human consumption</td>
</tr>
<tr>
<td>2001</td>
<td>EPA deleted from list of toxic materials</td>
</tr>
<tr>
<td>2010</td>
<td>Wall Street Journal commented that the EPA decision to eliminate the regulation on Saccharin was wise</td>
</tr>
</tbody>
</table>

**Source:** JMC's R&D Center
WHY JMC SACCHARIN?

Join the global consensus on premium grade Saccharin

JMC Saccharin

There are several Saccharin producers in the world, yet there is no other company besides JMC that boasts the longest history as well as the highest quality Saccharin production. JMC has over 65 years of production experience and know-how and is differentiated by using the best method for Saccharin production. JMC produces its own key raw materials for high purity Saccharin and uses potable water instead of organic solvents.

Accordingly, JMC supplies the best quality Saccharin to well-known international food companies as well as world-wide pharmaceutical companies. JMC Saccharin, the brand with the longest history and the best quality, works hard on benefiting its partners’ interests and convenience.

JMC is naturally the right choice for your company’s sweet future.
JMC’s premium quality starts with its choice of utilizing the Remsen & Fahlberg (R&F) Manufacturing Process. The R&F Process was originally developed by Dr. Remsen & Dr. Fahlberg when they discovered Saccharin at Johns Hopkins University in 1879. It is the foundation of JMC Saccharin’s competitive advantage.

The R&F Process is differentiated from other processes in which numerous irremovable impurities are produced. The R&F Process is the optimal method for creating high quality Saccharin since it does not produce impurities other than the OTSA residue, which can be eliminated by repeated purifications with potable water. Securing the quality raw material is difficult because it requires special technical handling with dedicated facilities. These requirements are a barrier to entry for new manufacturers.

Therefore, the R&F Process is available only to producers like JMC that already has the accumulated technologies, expertise and experience. JMC, while continuing to innovate, has the longest experience with the R&F Process among all current producers.

The exclusive status of JMC Saccharin proves the excellence of JMC’s R&F Process not only in all grocery applications but also in high-end food, beverage, personal care and pharmaceutical products.

JMC’s R&F Process requires OTSA (Ortho-Toluenesulfonamide) as a raw material. By contrast, other processes use a different raw material, PA (Phthalic Anhydride), which leads to the formation of numerous impurities during the synthesis. The R&F Process is the optimal method for high quality Saccharin since it does not produce any by-products. However, OTSA, the key raw material for Saccharin, is not abundantly available in the world market. Few companies manufacture OTSA because its isomers require special handling.

JMC self-produces 99+% purity OTSA by following JMC’s own quality regulations. By being completely vertically integrated JMC can stabilize its production without having problems in securing raw materials. Therefore, there is no outside factor to influence the production. Moreover, JMC monitors and controls every step in its entire process to ensure the best products that are required by our global customers.

JMC’s high quality Saccharin comes from the high purity raw materials.

JMC’s R&F Process

The optimal method for creating high quality Saccharin

Global Standards

JMC Saccharin complies with all Pharmacopoeias & Food standards.

JMC Saccharin conforms to all Pharmacopoeias & Food standards (USP/NE, FCC, JECFA, EP, EP9, JP, KP etc.). Currently all the global standards are identifying and ruling on the quality of Saccharin based on Saccharin produced by JMC. Why is that? It is because JMC’s production process is a widely proven process for high quality Saccharin. Also, JMC Saccharin is safe from CMR (carcinogenic, mutagenic or reprotoxic) and genotoxic materials. Moreover, JMC Saccharin is free from any allergen, irradiation, pesticides, GMO, BSE/TSE, gluten, latex and lactose, even though these are not regulated in Pharmacopoeias.

By contrast, Saccharin produced by the other method, using PA, contains impurities that are not measured by the current Pharmacopoeias. There are ever-increasing concerns about the risks of the impurities in Saccharin produced by processes other than the R&F method.
Since JMc uses OTSA, a high purity raw material, and the R&F Process, the optimal method for high quality Saccharin, there are no impurities in JMC Saccharin. By comparison, other producers use different raw materials such as PA, which contains various impurities such as methyl anthranilic acid, produced using ammonia, sodium hydroxide, and bromine. In addition, there are other impurities such as 1,2-benzothiazoline-3-one (BIT), Methyl anthranilate, Benzamide, Methyl benzoate, 2-Chlorobenzamide, etc. These impurities remain unrefined in Saccharin.

JMC thoroughly manages the quality of the water by its own strict standards. In addition, our water supply is subject to regular physicochemical and microbiological examinations by the local government. Multiple organic impurities produced from the process using PA can only be refined by using organic solvents. Even then, it is not possible to completely remove all impurities. Therefore, Saccharin produced by other methods contain various impurities as well as traces of organic solvents.

JMC produces Saccharin through oxidation without going through other steps and refines it. This is why there are no unintended impurities in JMC Saccharin.

JMC Saccharin is refined with potable water. High purity OTSA is used in JMC’s R&F Process and no organic impurities remain except the residual OTSA which can be refined using potable water. JMC Saccharin is fundamentally free from toxic materials due to the impurity-free process, raw materials and purification without organic solvents. JMC uses high quality water for purification and recrystallization. Multiple organic impurities produced from the process using PA can only be refined by using organic solvents. Even then, it is not possible to completely remove all impurities. Therefore, Saccharin produced by other methods contain various impurities as well as traces of organic solvents.
HOW SUSTAINABLE IS JMC?

We care about the welfare of our staff, the safety of our products and the impact of our operations on the environment.

**JMC** values our employees and actively supports their health, well-being and development. All employees are provided appropriate personal protective equipment and uniforms when they work. All workers are covered by employment insurance and are treated with respect. JMC does not permit child, forced or involuntary labor at any time. JMC provides all employees with freedom of association and the freedom to choose whether to participate in collective bargaining. These fair work conditions apply across the entire KISCO group of companies, including the provision of sickness and family leave. JMC actively enforces policies to prevent social or gender-based discrimination.

**JMC** is committed to manufacturing using sustainable processes that do not harm our employees or our environment. The water treatment systems in our facilities are monitored and strictly controlled to comply with government regulations. Korean government environmental standards are aligned with those of other developed economies and place a strong emphasis on environmental protection.
We practice transparent management. Operations that are legal and ethical are our highest priority.

- All of our business dealings are fair and honest to ensure that we maintain the trust of our shareholders, customers, employees and society at large.

- We practice a culture of management innovation that enables new technology to be developed through genuine engagement with our staff and delivers continuous improvements to our processes, products and prosperity.

- We are certified under ISO 9001: 2015, ISO14001: 2015, ISO45001: 2016, FSSC22000 (ISO22000: 2005 & ISO / TS22002-1). These include customer and legal/regulatory requirements, GMP and HACCP requirements that are applicable to us.

- We continuously monitor customer requirements and assist our partners by providing high-quality products and services that enable value-adding through improved productivity and strict quality control.

- By researching and developing ahead of time, we will supply new, high-quality sulfur-based products. We work to satisfy current customer requirements, understand future desires, maximize customer satisfaction and pursue the long-term growth of enterprises.

- Through effective communication processes, our quality assurance policies are shared with all employees and partners.

- We build, implement and continuously improve our integrated management system to meet the needs of our customers. We regularly review the adequacy, fulfillment and effectiveness of our quality assurance policies through internal audits and management reviews.

- We rapidly respond to domestic and international environmental policy changes to grow as a world-class fine chemicals manufacturer.

Since its foundation in 1953, JMC has been a leader in the manufacture, sales and service of saccharin products.

- JMC takes responsibility for the entire process from product planning, manufacturing, sales, distribution and disposal.

- Our products are developed in safe, hygienic facilities that are maintained to the highest standards.
JMC’s history of developing the world’s best Saccharin

1953 JMC (Jeil Moolsan Company) was founded
1954 Established Saccharin Plant for the first time in Korea
1981 Moved to the new plant at the current Onsan Industrial Complex for extension of production capacity
1997 Acquired ISO9001 from BV (UK)
2004 Incorporated into Kyung-In Synthetic Corporation Group
2005 Acquired ISO14001 and OHSAS18001 system from BV (UK)
2012 Acquired FSSC22000 from SGS
2017 Renewed ISO9001 and ISO14001 system from ABS GE(USA)

JMC has also been developing new technologies in Organic Synthesis to improve our existing processes and expand our product range.

1. Chlorosulfonation / sulfonation: ArH → ArSO2Cl, ArSO3H
2. Halogenation: R-OH → R-X (X=halogen), Ar-H → Ar-X (X=halogen)
3. Cyanation: Ar-X → Ar-CN, RCOX → RCON
4. Esterification: R'COH + ROH → R'COOR
5. Nitration and reduction: Ar-NO2 → ArNH2
6. Oxime formation: RCOCH2R' → RCONR'=N-OH
7. Benzoin condensation: 2ArCHO → Ar-CH(OH)-CO-Ar
8. Friedel Craft acylation: ArH + COCl2 → ArCOCl
9. Friedel Craft alkylation: ArH + RX → ArR
10. Oxidation
11. Phthalocyanine ring formation
12. Metal complexation
13. Pyrazine ring formation
14. Suzuki coupling: ArB(OH)2 + Ar′X → Ar-Ar′
15. Grignard coupling: Ar-MgBr + R-X(or CO) → Ar-R (or Ar-CH(OH)R)
16. Buchwald-Hartwig reaction: Ar-NH2 + Ar′-X → Ar-NH-Ar′
17. Kumada reaction: Ar-X + Ar′-MgBr → Ar-Ar′
18. Chloromethylation: ArH → ArCH2Cl
19. Radical polymerization
20. Polyester binder polymerization
21. Acrylic monomer synthesis

JMC Saccharin has gained official approvals for Quality, Safety, and Environmental Control from international authorities.