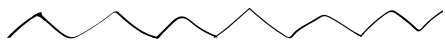




R&E

R&E

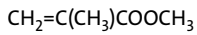
Contained substances of artificial marbles



35%

Methyl Methacrylate

MMA



64%

Aluminum Hydroxide



1%

Additives

Reactants, color regulator

R&E produces MMA and aluminum oxide by pyrolysis, calcination, and distillation process.



Methyl Methacrylate MMA

The raw material of artificial marble, etc., with outstanding strength and transparency, is used as a raw material for acrylic materials, lighting, and automobile lamps.

Product Use The raw material of poly methyl methacrylate (PMMA), artificial marbles, acrylic, automobile taillight, paint, and adhesives

Purity: more than 96.5%

Product Features Excellent transparency, high rigidity, weather resistance, exceptional formability, and machinability

MMA Properties

| Item | Test Method | Unit | Specification |
|---------------------|-------------|-------------------|---------------|
| Purity | JIS K 6716 | WT% | ≥96.5 |
| Color | ASTM D5386 | APHA | ≤10 |
| Water contents | ASTM D 1364 | WT% | ≤0.35 |
| TOPANOL-A | GC Method | WT% | As required |
| Appearance | | - | Liquid |
| Molecular weight | | g/mol | 100.1 |
| Specific gravity | | g/cm ³ | 0.94 |
| Boiling point | | ℃ | 100.2 |
| Melting point | | ℃ | -48 |
| Flash point | | ℃ | 10 (O.C.) |
| Auto ignition point | | ℃ | 421 |
| Solubility | | g/100g | 1.6 |

Al₂O₃ Aluminum Oxide

Alumina is a compound of aluminum and oxygen, "aluminum oxide," used as the main material for ceramics that require heat resistance, chemical resistance, and strength together with silica.

Product Use Raw material for tiles, refractories, ceramics, cement, etc.

Purity: more than 97.5%

Product Features Heat resistance, chemical resistance, strength

Aluminum Oxide Properties

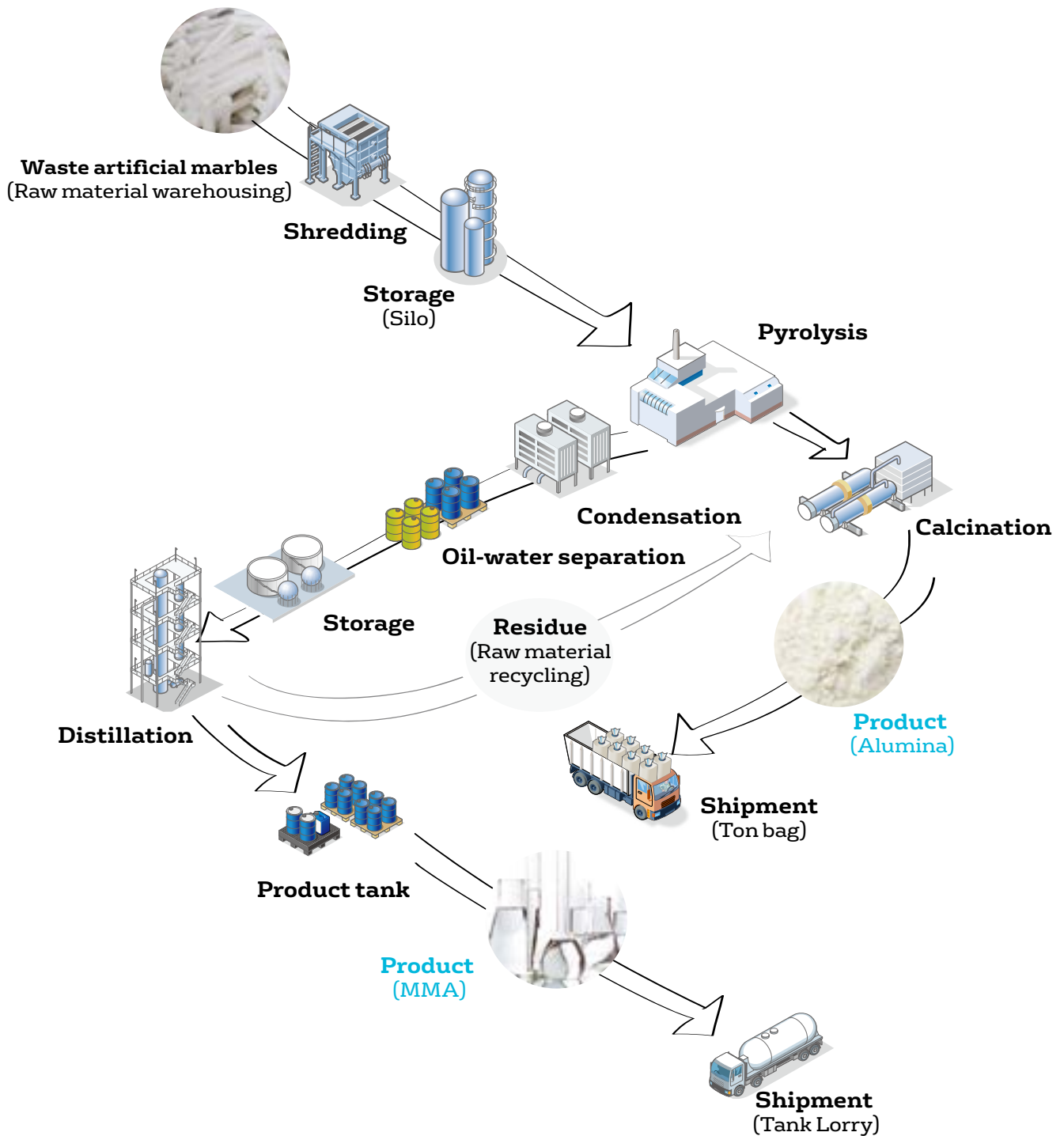
| Item | Unit | Product Name | | |
|--------------------------------|-------------------|--------------|-----------|-----------|
| | | RCA | NCA | HRA |
| Purity | % | 96.5~97.5 | 97.0~98.0 | 97.5~98.5 |
| TiO ₂ | % | <0.6 | <0.6 | <0.6 |
| CaO | % | <0.4 | <0.4 | <0.4 |
| SiO ₂ | % | <0.2 | <0.2 | <0.2 |
| Na ₂ O | % | <0.2 | <0.2 | <0.2 |
| Fe ₂ O ₃ | % | <0.1 | <0.1 | <0.1 |
| P ₂ O ₅ | % | <0.1 | <0.1 | <0.1 |
| MgO | % | <0.1 | <0.1 | <0.1 |
| K ₂ O | % | <0.1 | <0.1 | <0.1 |
| LOI1,100℃ | % | 1.0~2.0 | 0.5~1.5 | 0.5~1.0 |
| BET | m ² /g | 30~80 | 10~50 | 3~10 |
| d50 | μm | 11~14 | 11~14 | 11~12 |

| Item | Unit | Specification |
|------------------|-------------------|----------------|
| Appearance | - | Solid (Powder) |
| Molecular weight | g/mol | 101.96 |
| Specific gravity | g/cm ³ | 4 |
| Boiling point | ℃ | 2,980 |
| Melting point | ℃ | 2,072 |

- ▶ **World's first eco-friendly pyrolysis technology of waste artificial marbles**
- ▶ **Successful commercialization of recovery technology of high-purity MMA and alumina**

R&E has patented technology to recover MMA and aluminum oxide from waste artificial marbles. Pyrolysis is performed with scraps and dust of artificial marbles generated in the process of production of artificial marbles as raw materials. MMA, a volatile substance, is then separated, purified, and recovered, and the residue is completely combusted through a calcination kiln to remove remained impurities. It is finally oxidized to produce alumina.

Collecting raw materials from domestic artificial marble manufacturers



Company History

- 2006.04 Established R&E
- 2009.03 Acquired patent for Recovering Method of Methyl Methacrylate and Alumina from Waste Artificial Marbles (No. 10-0891378)
- 2010.03 Acquired patent for pyrolysis technology of waste artificial marbles and disposal system of waste artificial marbles using the same technology (No. 10-0917105)
- 2011.02 Acquired patent for the recycling method of waste artificial marbles, International patent application (No. 10-1022512)
- 2011.04 Established R&Tech Haman Plant
- 2012.06 Acquired patent for the calcination technology of waste artificial marbles (No. 10-1155126)
- 2012.12 Established R&E Oksan Plant in Cheongju
- 2018.06 Established an affiliated research institute
- 2019.12 Acquired by Veolia



R&E

Annual production capacity of all R&E sites



MMA

6,600 ton

Alumina

13,860 ton

Oksan Plant

MMA

2,400 ton

Alumina

5,100 ton

Haman Plant

MMA

1,800 ton

Alumina

3,960 ton

Changwon Plant

MMA

2,400 ton

Alumina

4,800 ton

Patents and registration certificate

- **Pyrolysis technology of waste artificial marbles and disposal system of waste artificial marbles**
(Patent No. 10-0917105, registration date: September 2009)
- **Recovering method of methyl methacrylate and alumina from waste artificial marbles**
(Patent No. 10-0891378, registration date: March 2009)
- **Treatment system of waste artificial marbles**
(Patent No. 10-1242763, registration date: March 2013)
- **Calcination technology of waste artificial marbles**
(Patent No. 10-1155126, Registration date: June 2012)
- **Recycling method of waste artificial marbles**
(Patent No. 10-1022512, Registration date: March 2011)

For details, please visit www.rne.kr.

R&E, an Eco-friendly Company

Produces high-quality MMA & alumina by recycling artificial marbles

R&E, a company recycling waste artificial marbles, has become a family member of VEOLIA since 2019.

R&E is the first company that developed new technologies to treat waste artificial marbles that caused air and soil pollution. This treatment allows to recycle MMA and alumina, hence contributing to recovering valuable resources and making an eco-friendly world.

During the process, alumina is produced and separated from refined MMA. The MMA and alumina can be used as a raw material for acrylics and ceramic products respectively. They are all evaluated as a high-quality material in various industries such as LED TV, textile, fireproof brick, ceramic and artificial marble. R&E's heat dismantling technology is the only patented in Korea.

VEOLIA

VEOLIA, the parent company of R&E, leads in the environmental industry by providing local governments and industries with water treatment and waste and energy management services. Since it has entered in Korea in 1999, around 1,500 employees currently work at more than 60 operation sites nationwide.

* The headquarters of the VEOLIA Group is located in France.

VEOLIA GROUP



WATER

Water Treatment

98 million

People provided with drinking water

67 million

People connected to wastewater networks

3,548

Water purification plants managed

2,835

Wastewater treatment plants managed

€11.1 billion (15 trillion won)

Revenues in 2019

- Operation management of water treatment facilities
- Production and supply of drinking water and industrial water
- Wastewater treatment service
- Recycling of treated and industrial wastewater
- Operation, maintenance, and optimization of treatment facilities



WASTE

Waste Management

42 million

People using waste collection services

50 million tons

Wastes treated

519,046

Customers from business establishments

675

Treatment plants operated

€10.2 billion (13.8 trillion won)

Revenues in 2019

- Recovery of energy and organic matters from waste & production of raw materials
- Recycling of waste plastic
- Sorting, treatment and recycling services for designated & non-designated waste by incineration, composting, landfilling & physical-chemical treatment
- Recycling of unused wood resources (wood chip production)



ENERGY

Energy Services

41 million Mwh

Energy produced

45,097

Thermal installations managed

2,357

Industrial facilities

591

Heating and cooling networks managed

€5.9 billion (8 trillion won)

Revenues in 2019

- Energy management: distant heating and cooling
- Industrial energy services: steam and electricity supply
- Design, construction, operation, and maintenance of cogeneration (CHP/ Combined Heat and Power) and utility facilities
- Carbon footprint reduction through biomass, cogeneration development, and energy recovery

Resourcing the world  **VEOLIA**

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www.rne.kr
www.veolia.co.kr