Zeolite Applications

What is Zeolite? And Why Is It So Valuable?

A mineral is a naturally occurring chemical compound, usually of crystalline form and abiogenic in origin (not produced by life itself). What is the difference between a mineral and a rock? A mineral has one specific chemical composition while a rock aggregates different minerals and mineraloids.

We have very rich in some types of minerals and one of them is Zeolite. The best type of Zeolite is Clinoptilolite and has a unique position in the world in terms of the sheer amount - largest deposit, and its purity **(Up to 97%)**.

Zeolite is used in many different industries and in many everyday products. With the development of new technologies, zeolite is expected to become even more valuable in the future.

Example Industrial Zeolite Applications

1. It captures and prevents the release of explosive gases.
2. It increases productivity by conserving energy.
3. It is used for hardening alloys.
4. It captures and removes heavy metals and toxins found in waste water.
5. It captures and removes heavy metals and toxins found in the ground.
6. It captures ammonia.
7. It acts as a cement additive to help construct more durable buildings.

Did you know?

We can see that the capacity of zeolite has been increasing towards the west if we look at the zeolite deposits of Italy. It is considered these deposits

1.5 bln tons Geological reserve of Zeolite

150 mln tons Proved global reserve of Zeolite

Zeolite Applications

6 mln tons Annual Zeolite usage in the world

1- Zeolites can save water

The minerals increase the water holding capacity of soil and reduce watering requirements by up to 50%.

2- Zeolites can remove toxins

They have a helical and negatively charged molecular cages, so they adsorb and lock in ammonia and harmful heavy metals, removing them from the surroundings

3- Zeolites are known to help with following conditions:

skin diseases, malignant diseases, spinal diseases (the lumbar part), gastrointestinal diseases, diabetes, cardiovascular diseases, hematopoietic diseases, central nervous system diseases and neuromuscular disorders, liver diseases

4- Zeolites are uniquely safe product

Studies show they remain in the human body for approximately 5 to 7 hours before they are fully excreted

5- Zeolites give off heat when rehydrated

You can try it by placing a rock on the tongue – it will heat up, if it has enough zeolite

6- Zeolites trap odours, such as lingering cigarette smoke or shoe stench

Place a bowl or mesh bag of zeolite in a room with lasting smell and enjoy the clean air. Just a few zeolite rocks near your foot locker will cut back on smell and trap moisture.

7- Zeolites absorb and dispel the nasty smell from your cat litter box

so you don't have to use vast amounts of air freshener. Same will happen if you put some pieces of the mineral at the bottom of your waste bag - they will absorb the unpleasant smell and moisture.

8- Zeolites give longer life to fresh produce

The rocks can absorb ethylene (a gas that hastens decay), so you can actually enjoy everything in your fruit bowl for longer

9- Zeolites adsorb radiations

Zeolites have been used to adsorb and remove radioactive isotopes at the sites of nuclear power plant incidents

10- Natural zeolites are the most effective filters

Natural zeolites are the most effective filters yet found for absorbing sulfur dioxide, which causes acid rain, from waste gases.

11- Zeolites have large surface

Zeolites have large surface areas because of their open crystal structure

12- Zeolites is used even is space

Zeolites were used as "soil" for NASA's first attempt at landless agricultural practice in space.

13- Zeolite comes from the volcanoes

Clinoptilolite zeolite is a natural inorganic mineral that is formed when volcanic ash is spewed into the atmosphere during violent eruptions. The volcanic ash plumes often travel thousands of miles before they are deposited on the earth's surface

14- The first science book on Zeolites was published in 1989

The first science book on Zeolites was published in 1989 and it consist of 1463 pages. You can still get it nowadays for about $ 400

Pollution control

1. Absorbents for oil and spills: Zeolite is ideal for granular oil/chemical spill cleanup - it is inert and safe to use.

2. Radioactive Waste Treatment - Site remediation / decontamination as been done in at Three Mile Island nuclear power plant, at Chernobyl nuclear power plant and at Fukushima nuclear power plant.

3. Water treatment: Water filtration, Heavy metal removal, Swimming pools - in swimming pools, ammonium ions often react with the free chlorine to form chloramines. They are irritating to the eyes and skin. Zeolites remove ammonium ions by means of ion-exchange and, at higher concentration, adsorption. The ammonium ions present in the wastewater are exchanged for sodium ions. The adsorption of heavy metals by zeolites is largely analogous to the removal of ammonia.

4. Wastewater treatment: Ammonia/ammonium removal in municipal sludge/wastewater, Heavy metal removal, Septic leach fields, Removal of organic substances, Removal of solids

The structure of the inner surface makes zeolites suitable as a carrier material in both aerobic and anaerobic biological waste treatment installations.

An advance using them is that a number of substances, which are being metabolized by bacteria, are also adsorbed by zeolites. This causes for example ammonium to be removed from the first moment and it is thus not necessary to wait until a stable bacteria column has formed. Further to this the zeolite acts as a buffer for ammonium ions; in case of a large ammonia production, part of the ammonia is adsorbed by zeolite and if the ammonia concentration is low, the bacteria metabolize part of the adsorbed ammonium.

Zeolites adsorb a number of organic substances. The mineral has the largest affinity for polar organic components, for example chlorinated hydrocarbons. Depending on the diameter of the molecules, these are either adsorbed in the micro or mesopores. The capacity of the adsorption is strongly dependent on the circumstances at which the adsorption is performed. At the moment, further investigations are still being performed in this field of interest.

As zeolites are a granular material, solid and suspended particles are trapped between the grains. The porous structure also causes colloid particles from both organic and mineral origin to be removed from the water. The capacity for the removal of solid particles is up to 45% greater than the capacity of sand with an equivalent particle size distribution.

ENERGY INDUSTRY

1. Oil refining and petrochemical - Zeolites are being used as catalysts in fluid catalytic cracking and hydrocracking, because of their superior activity, stability and selectivity in major conversion and upgrading processes as compared with their amorphous equivalents.

2. Biogas - A zeolite substance, developed by Fraunhofer e.V., can store energy at a density 4x more than water.

3. Solar energy - Zeolites can be used as solar thermal collectors and for adsorption refrigeration, because they have high heat of adsorption and ability to hydrate and dehydrate while maintaining structural stability. This hygroscopic property coupled with energy releasing reaction when transitioning from a dehydrated to a hydrated form make natural zeolites useful in harvesting waste heat and solar heat energy.

4. Purification of Natural Gases - Zeolites are used to purify natural gases removing impurities as carbon dioxide, sulphur dioxide and water. They are also used to separate oxygen and nitrogen in pressure swing adsorption columns.

AGRICULTURE & LIVESTOCK

1. Aquaculture: Ammonia filtration in fish hatcheries - If you grow a lot of fish, they will quickly pollute the water, which will lead to increase in toxic substances. This means extensive water purification. Zeolites can be used as a secondary filtration unit, as a support material for bacteria, and as a filter.

2. Agriculture: Odour control, food additives - Zeolites have been used for a very long time in agriculture. 5% addition to livestock rations reduces ammonia and odour emissions, improves feed utilisation, assists with mycotoxin absorption and may contribute trace elements.

3. Soil Conditioner

4. Horticulture: Nurseries, Greenhouses, Vegetables, Herbs, Tree and shrub transplanting, Turf grass soil amendment, Hydroponics - Because of its high bonding capacity for ammonium, potassium and other ions, Clinoptilolite is used highly in in agriculture.

Clinoptilolite holds the most important ingredients, that help the plant growing, in its crystalline structure until the plant roots seeks them.

5. Household products: Household odour control, Pet odour control, Compost - A range of gases including formaldehyde and hydrogen sulphide has been shown to be adsorbed by zeolite. Zeolite is added to small air filters to adsorb such gases and reduce allergy problems. It can be used to dry sports shoes, reduce moisture in wardrobes and adsorb cigarette odours. Same goes for kitty litter. Zeolite is also used as a fat absorber for barbecues. When fully utilised, the spent product makes an ideal addition to composts where it will assist in conditioning and eventually contribute to soil moisture and nutrient holding capacity

Zeolite Applications

MINING & METALLURGY

1. Mining - Remediation of mines through absorption and retention of dangerous heavy metals and other metallurgical wastes. Studies show that zeolites increase the general PH of ponds, which cause metal-bearing solid phases to precipitate, enhancing the efficiency of the decontamination process. Clinoptilolite can remove up to 98% of copper, iron, cobalt and gold from contaminated water.

2. Metallurgy - Zeolite can absorb many heavy hazardous metals used in the field of metallurgy. Also, it diminishes the dangerous fumes created in pyrometallurgy

OTHER INDUSTRIES

1. Detergent - Zeolites are extremely useful in the production of soaps and detergents. They have replaced phosphates as water-softening agents, as they exchange the sodium in them for the calcium and magnesium, found in water.

2. Home appliances - Zeolites are being used in dishwashers to reduce water and electricity usage.

3. Auto building industry - With the growing need of clean air in the cities, zeolites have made they war into the cars as part of the catalytic converters.

4. Medical:

- Against diarrhoea from food poisoning.
- As haemostatic agent.
- Reduces muscle pain from lactic acid
- Reduces fungal foot infections
- Reduces hangovers
- Reduces nicotine and tar in cigarette filters
- Inactivates the effect of Hepatitis viruses
- Stabilizes and regulates immune system
- Reduces side effects of chemotherapy

5. Paper - Because of their brightness zeolites are being used as paper fillers in the paper industry. The papers made from zeolite are lighter and absorb ink better, thus creating economic advantages.

6. Construction - Zeolite is excellent additive in concrete. It's lighter can replace up to 40% of the cement. Zeolite is 50% lighter than sand and its particle sizes are less coarse, so zeolite spreads easier and provides a smoother surface. Zeolites have greater resistance to chemicals and corrosion. It's Environmentally friendly

Zeolite Applications

Where & Why To Use	Use Rate	How To Use	How long to Use
Rooms - Home or Office Smoke & cooking odors, pet odors, perfumes, paints, or chemical odors.	1-2 kg. per sq meter until odors are gone, then 1 kg.per sq. meter for maintenance. They are available in small and big breathable bags	Hang the breathable bags in rooms, place between books, hang between clothes in wardrobes, hang behind doors in bathrooms and laundry—do not block the normal air flow.	Replace them after 10-14 days
Heating & Air Conditioning Vents — Prevents odor transfer from room to room.	1/2 kg. Per small vent. 1kg. per large vent.	Discard Odor—Pad is used as the component of the filter by the manufacturers. It can be hanged, in the bags provided, just in back of the filtering systems. You need 0 be careful not to block the free air flow into the filters.	Discard Odor-Pad with filter in case it is used in filters. Replace the bags after 10-14 days
Carpets, Rugs, Upholstery - Pet silage, food spills, chemical odors from outgassing of new materials.	2-6 cups per sq. meter. The use varies based on severity of spoilage and odors.	Sprinkle directly on odorous carpets and rugs or pet beds and new furniture or even new beds.	Wait 45 minutes or up to 24 hours. Vacuum.
Closets, Wardrobes, Storage Boxes & Bags, Drawers & Cabinets - Smoke, mildew, mustiness, excessive moisture.	Storage areas like these are usually more densely packed; they may require 3 —5 pairs of breathable bags in each space to avoid moisture or odors.	Hang or place in areas where air flow is not restricted, and/or lay on top of stored items or in with the stored items. Use liberally.	Replace the bags after 7 days.
Bathroom & Laundry - Mildew, mustiness, bathroom odors, excessive moisture.	4-6 pairs of the breathable bags for airborne areas. Or just use Odor—Pad powder	Use "S" hook to hang on backside of the doors and in hampers. Sprinkle powder around tubs, toilets, and washing machines.	Replace the bags after 5—7 days. Collect or wash the powder away the breathable bags of Odor-Pad Within 24 hours.
Nursery — Diaper pails, spills, spoilage, common nursery odors.	1kg. per sq. meter for odor control. 2 to 6 tsp. per ¼ sq. meter. On carpeted areas. 50-70 gr. in pails.	Hang in rooms, do not block normal air flow. Use "S" hooks to hang in diaper pails. In severe cases add some powder to pail and wash out powder by rinsing twice.	Remove the bags within 5 days. Vacuum the powder within 24 hours
Sports Lockers & Gyms - Foot & mildew odors as well as preventing cracking and mildew in footwear.	Use 2-4 pairs of breathable bags of Odor—Pad in lockers. 2-3 pairs of breathable	Hang or lay the units of Odor—Pad in locker, lay in gym bag. Sprinkle powder in shoes or use breathable bags	Use the bags in the shoes overnight. Discard the granules used in the indoor area of the gym

	bags of Odor-Pad in a gym bag. 1-2 of the same bags in each shoe. Use the sufficient amount of Odor—Pad in different areas of the gyms to prevent the built—up of sweat odor in the indoor areas. The suggested amount is 2-3 kg per sq. meters.	when your shoes are not in use. Use the Odor-Pad granules in the containers which have extended areas.	after 2-3 days.
Walk-In Coolers & Refrigerated Display Cases - Odor control extends shelf life of meat, fish, fruit, flowers, vegetables, eggs and dairy.	1 kg. per 1 sq. meter. Until odors are gone, then 2 kg. Per 2 sq. meters. for maintenance.	Hang the large breathable bags in the areas of maximum air flow or in return vents. The suggested units will prevent cross contamination of fish smells.	Replace them within 4 days
Vehicles - Odor-Pad helps to alleviate fumes in passenger and Recreational vehicles and boats from outgassing of vinyl, paneling, odors from hunting, fishing, mildew, etc. Helps to absorb the toxic deodorizing agents used by previous owners as well as smoke and tobacco odors.	1/2 to 1 kg. per vehicle. 6 to 10 tsp. per so. meter. On carpeted areas.	Place the suggested units under front seats of vehicle. Sprinkle on carpeted areas	Vacuum after 24 hours. the powder sprinkled
Domestic Animals — Control pet urine and excrement waste odors of all types in home and kennel Odor—Pad can then be used to reduce flies in outdoor runs by absorbing excess fluids.	1/2 to 1 kg. per vehicle. 6 to 10 tsp. per so. meter. On carpeted areas. 400gr in litter mixture. 1.5-2 kg, in case Odor-Pad to be used as a litter itself	Use suggested units in small kennels and pet sleeping areas. Sprinkle in litter boxes and on runs. Odor—Pad sprinkled in animal houses needs to be collected within 7 days.	Odor—Pad as a litter needs to be replaced after 7 days
Trash/Garbage Com post Bins— Eliminates odors from waste materials, controls flies. Great amendment for organic compost.	4-6 cup of the powder in trash containers. 1 cup of powder in compost pails.	Sprinkle powder in and around trash bins. Add to garbage used for compost, or hang around trash areas.	Discard Odor—Pad with the garbage
Shoes & Boots - Eliminates odors from sweat and foot fungus, and mildew from	1-2 pairs of the breathable bags in each shoe or boot.	Place the bags in the shoes. Or, sprinkle powder in shoes, boots, on feet. Shake out over	Place the breathable bag in the shoes overnight Wash, collect

footwear. Soothes tired feet.	Or, sprinkle directly on foot.	trash before wearing, Rub gently between toes.	or clean the powder away when odor or the moist in gone
In aquariums and bird	100—15 gr. per sq. meter at the bottom of aquariums with the rate of 50/50 as a component of aquarium filters half a cup per 40 square centimeters at the bottom of bird cages	To absorb poisonous ammonium sprinkle Odor-Pad onto the bottom surface of aquariums. The filter manufacturers use Odor-Pad as a component within filters. At the cage of birds it will help to absorb odor and moist without any risk to their lives.	Replace Odor-Pad in the aquariums after 3-5 days. Discard filters with Odor-Pad inside, after being exhausted. After a week replace Odor-Pad used in the birdcage.
In the basements, storehouses and dark spaces	1 kg per sq. meters	Sprinkle Odor-Pad, at the amount mentioned, onto the floors of the basements, storehouses and dark spaces where it is supposed that there could be moist, mildew etc.	Replace Odor-Pad after 5—7 days and it will guarantee the well—being of your things stored in those areas.
In the ashtrays of your house, office or car	A teaspoon full	Used in the ashtrays it will help you to remove smoke odor from the ash and help to extinguish the cigarette easily.	Discard Odor—Pad with the ash
In the toolboxes, cases of musical instruments and other boxes.	2—4 pairs of breathable Odor—Pad bags.	Put the breathable bags in the boxes/cases and it will keep your valuable, expensive instruments safe by absorbing the moist.	Replace the bags after 7—10 days.
Refrigerators & Freezers-Saves energy. Absorbs odors. Promotes freshness. Food lasts longer. Eliminates ice crystals.	Use 3-4 pairs of breathable bags in fridge on different shelvesUse 2 pairs of bags with green veggies to avoid ripening and mold Use 2 pairs of bags with fruit bowl to avoid ripening	Place in the areas of highest air circulation, normally the second shelf at the rear of refrigerator and with sections storing veggies and freezer	Replace them after 4-7 days