



**ARENITO MINERALS & CHEMICALS CORPORATION**

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**DURABILITY OF KMI's ZEOLITE  
aka ZEOFILL IN SPORTS FIELDS  
INFILL APPLICATIONS**

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## **Introduction**

Arenito Minerals and Chemicals Corporation (“Arenito”) was requested by KMI Zeolite Inc. (“KMI”) to report on the durability of KMI zeolite’s brand ZeoFill in sports fields. This report is to address the durability of ZeoFill during hydration and dehydration, as well as freezing and thawing in sports field infill applications. The results represented here refer only to KMI zeolite, which is 97%+ pure and contains no clays. Clays are water soluble and may exist in other zeolites, in up to 15%, which results in degradation when in prolong contact with water.

The Technical Data Sheet for KMI zeolite shows the purity of the ZeoFill as determined by Xray Diffraction (XRD) and Scanning Electron Microscope (SEM) analysis. Both XRD and SEM should be used when comparing zeolites. *Attached as Plate 1 is the Technical Data Sheet for the KMI zeolite.*

## **Durability of KMI Zeolite in Repeated Cycling from Hydration to Dehydration**

Examination of the KMI in repeated cycling from hydration to dehydration has been observed in a wide number of applications. KMI zeolite is used in water filtration and as a desiccant to absorb/adsorb liquids, where experience demonstrates degradation of the KMI zeolite is not an issue. *See attached Plate 2 Testing Hydration and Dehydration.* The hydration/dehydration test confirms there is no degradation, nor any swelling of the zeolite. KMI zeolite’s swelling index is nil. *See Swelling Index on Plate 1.*

## **Durability of KMI Zeolite in Repeated Freeze/Thaw Cycling**

The durability of the KMI zeolite during the freeze/thaw cycle was tested in November 2014. This study was conducted outdoors during temperatures continuously below freezing. The test procedure was to place the zeolite on ice in a container. By means of solar absorption, the zeolite was slowly absorbed through the ice to the bottom of the container. The block of ice was then turned over and the zeolite once again went through the ice, back to the bottom of the container. This procedure was repeated several times, always with the same result - there was no degradation of the KMI zeolite. *See attached Plate 3 Repeated Freeze/Thaw Cycling.*

## **Results**

KMI zeolite can withstand freeze/thaw cycles indefinitely without degradation in the same manner as the hydration/dehydration cycles, exemplifying the purity of the KMI zeolite assures the performance in varying weather conditions.

## **Conclusions**

Neither moisture, freezing temperatures, nor extreme heat conditions contribute any degradation of ZeoFill on the sports field. ZeoFill is thermally stable. There is no structural integrity of the zeolite lost by repeated freeze/thaw or hydration/dehydration cycles.

Moisture and cold/hot temperatures do not have any bearing on the degradation that will happen on the sports field infill over time due to repeated impact.

**Plate 1**

**TECHNICAL DATA SHEET**

*Hydrous Sodium Aluminosilicate*

*Natural Clinoptilolite*

*Zeolite Granules and Powders*

**TYPICAL PROPERTIES**

<i>General Chemical Formula</i>	<i>Na<sub>6</sub>[Al<sub>6</sub>Si<sub>30</sub>O<sub>72</sub>]24H<sub>2</sub>O</i>
<i>Clinoptilolite Content</i>	<i>97%+</i>
<i>Cation Exchange Capacity (CEC)</i>	<i>1.6 – 2.0 meq/g</i>
<i>Form</i>	<i>Granules and powders</i>
<i>Shape</i>	<i>Angular</i>
<i>Color</i>	<i>Gray – green</i>
<i>Pore Diameter</i>	<i>4.0 – 7.0 angstroms</i>
<i>Specific Gravity</i>	<i>1.89</i>
<i>Specific Surface Area</i>	<i>40m<sup>2</sup>/g</i>
<i>Bulk Density</i>	<i>50 - 65 lbs/ft<sup>3</sup></i>
<i>pH (natural)</i>	<i>7.0</i>
<i>Alkali Stability</i>	<i>pH of 7 - 10</i>
<i>Acid Stability</i>	<i>ph of 3 - 7</i>
<i>Hardness</i>	<i>4.0 - 5.0 Mohs</i>
<i>Swelling Index</i>	<i>Nil</i>

**TYPICAL CHEMICAL ANALYSIS**

<i>SiO<sub>2</sub></i>	<i>Al<sub>2</sub>O<sub>3</sub></i>	<i>Fe<sub>2</sub>O<sub>3</sub></i>	<i>CaO</i>	<i>MgO</i>	<i>Na<sub>2</sub>O</i>	<i>K<sub>2</sub>O</i>	<i>MnO</i>	<i>TiO<sub>2</sub></i>
<i>66.7</i>	<i>11.48</i>	<i>0.9</i>	<i>1.33</i>	<i>0.27</i>	<i>3.96</i>	<i>3.42</i>	<i>0.025</i>	<i>0.13</i>

*This product contains no detectable crystalline silica*

**MAJOR EXCHANGEABLE CATIONS**

<i>Rb+</i>	<i>Na+</i>	<i>Ba<sup>2+</sup></i>	<i>Mg<sup>2+</sup></i>	<i>Li+</i>	<i>Ag+</i>	<i>Sr<sup>2+</sup></i>	<i>Fe<sup>3+</sup></i>	<i>K+</i>	<i>Cd<sup>2+</sup></i>
<i>Cu<sup>2+</sup></i>	<i>Co<sup>3+</sup></i>	<i>Cs+</i>	<i>Pb<sup>2+</sup></i>	<i>Ca<sup>2+</sup></i>	<i>Al<sup>3+</sup></i>	<i>NH<sup>4+</sup></i>	<i>Zn<sup>2+</sup></i>	<i>Hg<sup>2+</sup></i>	<i>Cr<sup>3+</sup></i>

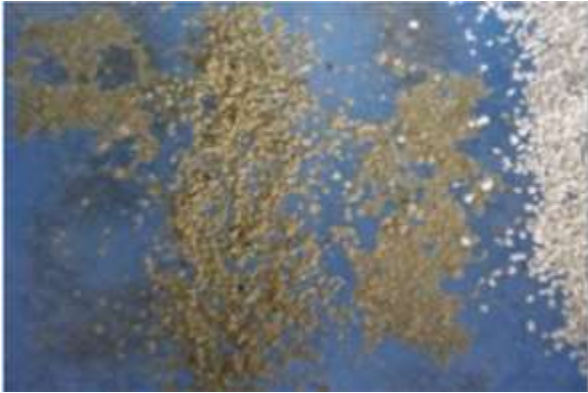
Plate 2



*Hydration/Dehydration Test*

*As water evaporates, the KMI zeolite grains resume their dehydrated color with no degradation or change in shape or swelling.*

Plate 3



***Repeated Freeze/Thaw Cycling Test***

***As the KMI zeolite grains move through the ice to the bottom, the block of ice is turned over and the process repeats itself with the same result every time – no degradation of the zeolite.***