

Use of Natural Zeolite Stilbite in Soil Available Near Ajanta Ellora Caves

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Abstract— Natural Zeolite Stilbite was collected near Ellora Ajanta belt.Characterization was made using XRD, IR as usual method. Application of natural zeolite Stilbite was done with soil and result was reported

I. INTRODUCTION

Stilbite is a natural zeolite belonging to the Heulandite group with unit cell formula $\text{Ca}_4[(\text{AlO}_2)_8(\text{SiO}_2)_{28}]28\text{H}_2\text{O}(1)$. The zeolite framework can be described as a fundamental polyhedral configuration containing four and five member rings of tetrahedra. Two sets of interconnected channels exist in the Stilbite structure. A larger 10 – member ring channel with

$4.91\text{\AA} \times 6.2\text{\AA}$. window size in the [100] direction and a smaller eight ring channel with the size of $2.7\text{\AA} \times 5.6\text{\AA}$ in the [101] direction (2). The inner surface should therefore be readily

accessible to the small molecules. Stilbite is a monoclinic zeolite .the unit cell constants is $a = 13.61\text{\AA}$, $b = 18.24\text{\AA}$, $c = 11.27\text{\AA}$, $\beta = 127^\circ 54'$ Stilbite zeolite could potentially be used as an adsorbent and catalyst. It is generally believed that collapse of the Stilbite structure during dehydration is due to the presence of exchangeable cations [3]. When removing the water

molecule legends, the cations must coordinate directly to the oxygen in the framework. Because of their high charge density, the cations can distort the frame work to achieve the best environment for possible coordination. The distortion in Stilbite is so serious that some of the bonds connected to tetrahedral atoms (Silicon or aluminum) break, rendering the zeolite almost useless as an industrial catalyst or dehydrating agent (4) Since destruction of the Stilbite framework is closely resulted to the exchangeable cations it might be possible to stabilize the framework by reducing the number of exchangeable cations. Beyer et al (5) performed a thermogravimetric study of the de ammonation of NH_4 – Stilbite in oxidizing and insert atmosphere and reported the structure variation of the H-Stilbite thus formed Mortier and coworkers (6) investigates the crystal structure of NH_4 – Stilbite dehydrated at 300°C , and found only a minor distortion with respect to the hydrated form. The framework

remains open and the residual cations are located in eight rings.In the case of Stilbite, the hydrogen form is more stable

(7,8). The framework of NH_4 – Stilbite heated in a shallow bed

reactor remains upto the temperature of 500°C . The thermal stability of the zeolite increases with increasing degree of ammonium exchange. The thermal behaviour of Stilbite is studied recently (9). The collapse of the frame work can be prevented by reduction of the cation /framework interaction

II. CHARACTERIZATION

For natural zeolites and synthetic zeolites, x-ray powder diffraction methods are commonly used for the structural investigations and also for the purpose of identification. In the present investigation, the bragg diffractometer arrangement is used. The specimen in the form of micro crystalline powder is mounted in the sample holder, which is then placed at the center of the diffractometer and rotated by an angle 2θ around ω axis in the sample plane. The counter is attached to an arm rotating around the same axis by angles twice as large as those of the specimen rotation only (hkl) planes of the micro crystals parallel to the sample plane contribute to the diffracted intensity

File name: C:\Xpert Data\Stilbite.xrd
Sample Identification: Stilbite
size 2 Theta: 0.001, Minimum step size Omega: 0.001
Sample stage: PW3071/scx Bragg-Brentano
Diffractometer system: XPERT-PRO
XRD measurement (° 2Theta)
Raw Data Origin: Goni
Scan Axis: Goni
Start Position [° 2Th.]: 5.0050
End Position [° 2Th.]: 59.9950
Step Size [° 2Th.]: 0.0100
Scan Step Time [s]: 0.1000
Scan Type: Continuous
Offset [° 2Th.]: 0.0000
Divergence Slit Type: Fixed
Divergence Slit Size [°]: 0.9570
Specimen Length [mm]: 10.00
Receiving Slit Size [mm]: 0.3000
Measurement Temperature [°C]: 25.00
Anode Material: Cu
K-Alpha [Å]: 1.54060
Generator Settings: 40 mA, 40 kV
Diffractometer Type: 0000000011059234
Diffractometer Number: 0
Goniometer Radius [mm]: 200.00
Dist. Focus-Diverg. Slit [mm]: 91.00

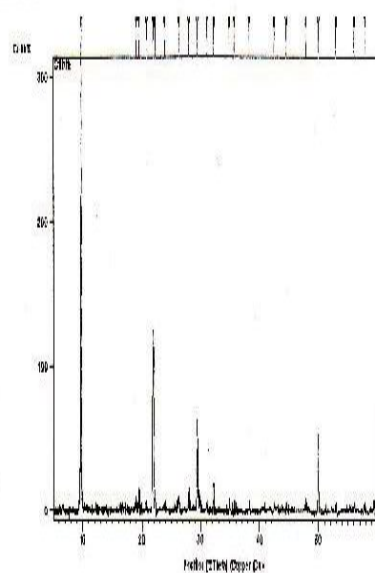
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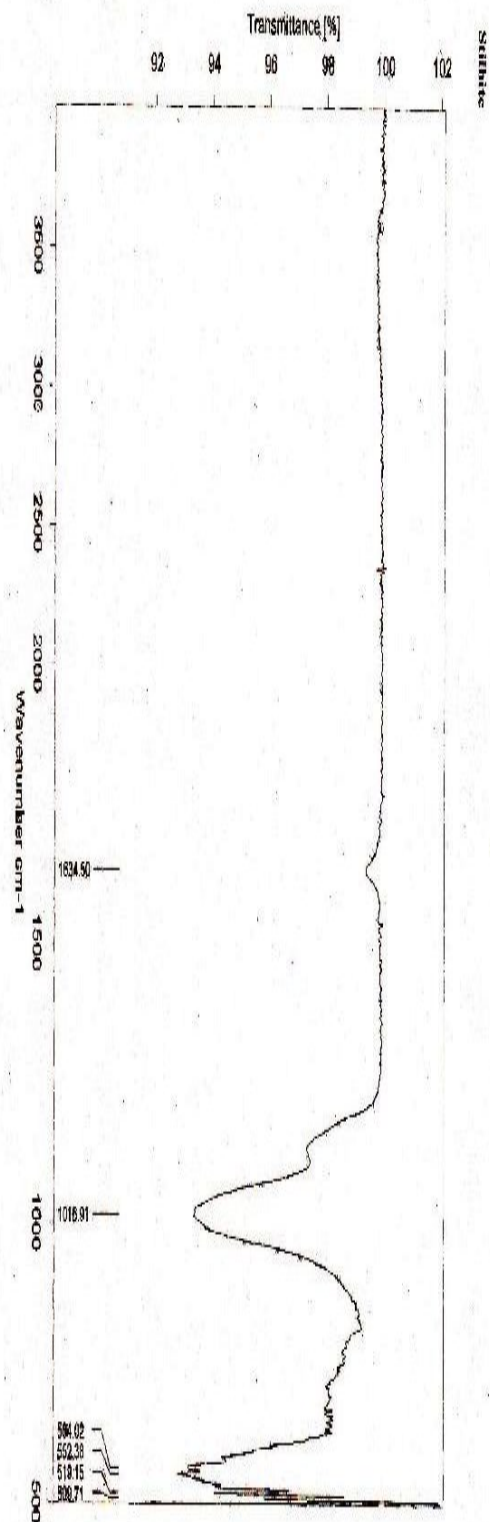
Dr.S.B.Kolhe, Shivaji college kannad, Dist.Aurangabad

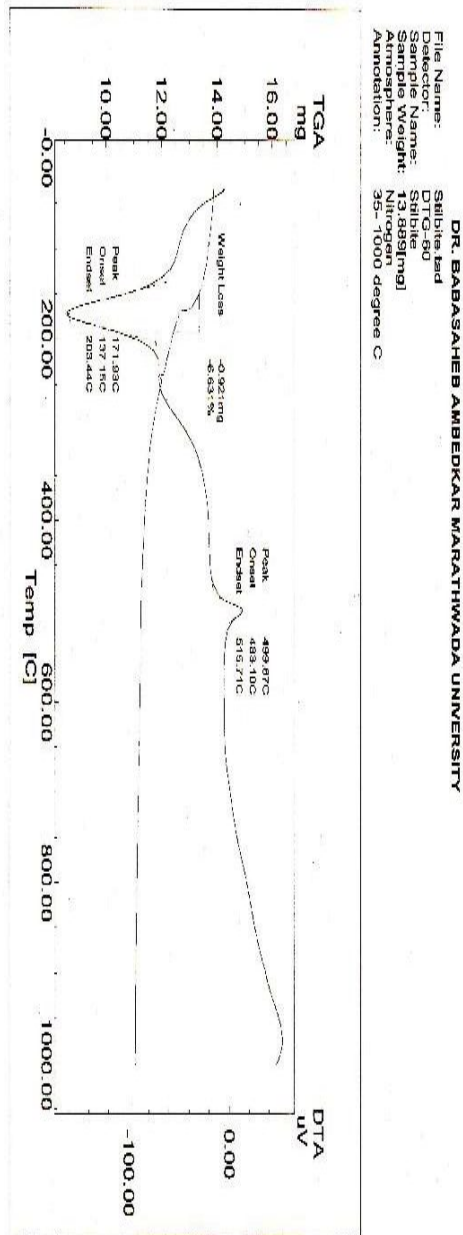
Graphics:



Peak List:

Pos.[°2 θ]	Height[cts]	FWHM[°2 θ]	d-spacing[Å]	Rel.Int.[%]
9.7038	308.13	0.0984	9.10726	100.00
19.0561	6.77	0.1574	4.65351	2.20
19.4555	11.85	0.1378	4.55888	3.84
20.7351	4.97	0.2362	4.28034	1.61
21.8726	123.91	0.1771	4.06024	40.21
22.1675	12.88	0.1181	4.00688	4.18
23.8042	3.73	0.6298	3.73496	1.21
26.2027	9.40	0.1574	3.39827	3.05
27.9684	11.92	0.1181	3.18760	3.87
29.3962	62.92	0.1771	3.03595	20.42
31.0606	6.92	0.1968	2.87696	2.24
32.2146	13.91	0.1574	2.77648	4.52
34.8966	7.86	0.1968	2.56899	2.55
35.7287	7.79	0.1574	2.51105	2.53
38.2547	4.81	0.3149	2.35085	1.56
42.5538	4.80	0.2362	2.12277	1.56
44.5932	4.59	0.2362	2.03030	1.49
47.8933	6.75	0.2362	1.89782	2.19
49.9572	33.96	0.1968	1.82414	11.02
52.9314	1.81	0.2362	1.72844	0.59
56.1071	4.53	0.2362	1.63790	1.47
57.9143	-1.12	0.5760	1.59102	-0.56





ZEOLITE IN SOIL

Plant Growth

The wide use of fertilizers and the other chemicals in agriculture and their leaching from the soil causes pollution of the environment and increases retention of chemicals in plants and the soil. In this respect a significant role is played by the natural zeolites which have the high ion exchange retention capacity.

Natural zeolites can absorb ammonium and potassium ions and then release them gradually into the soil solution. Thus zeolites in the soil can prolong the effects of mineral fertilizers. The great affinity of natural zeolites for the water and their capacity to retain it can also affect the soil water regime. Natural zeolites can increase the pH of the medium as well effects of Clinoptilolite tuffs on soil productivity are well known. According to Japanese workers the cropping capacity of carrot, apples and wheat increases with introduction of the Clinoptilolite (15 – 63%). Natural Japanese zeolites for use as soil conditioners are exported to Taiwan. Introduction of ammonium and potassium Clinoptilolite increased the cropping capacity by 26%. Good results have been obtained for wheat when Clinoptilolite tuffs are introduced into the soil. The soil retains the water better when 5 to 10 tones of Clinoptilolite are added per hector (10)

Zeolite In Soil Erosion

Synthetic zeolite, made of coal fly ash, a waste product of the electrical power plants increased soil aggregation and permeability therefore soil erosion was reduced. It was assumed that sodium cations were substituted by calcium cations from the synthetic zeolite as a result, dispersion of the soil was retained and soil permeability increased (11). In present application stilbite is used in soil. Result of mixing soil with stilbite and without stilbite is shown below.

शेतकऱ्याचे नांव :- व्हा. पी. रेखापांडे
पत्ता :- गांव :- पांडे पोस्ट :-
तालुका :- मानसंग जिल्हा :- परभणी
सर्वे नं. :- 284/सी-9 पुढील रिक :-

अ.क्र.	गुणवर्धन	निरीक्षण (बी.पी.एम.)	सर्वसाधारण प्रमाण (बी.पी.एम.)	शिफारस
१	तांबे (कोपर)	<u>2.92</u>	0.2	** / जमिनीतून १० ते १२ किलो / हे. कोपर सल्फेट किंवा फायरलीद्वारे १ टक्के
२	लोह (आयन)	<u>2.66</u>	४.५	** / जमिनीतून २५ ते ३० किलो / हे. फेरस सल्फेट किंवा फायरलीद्वारे ०.५ टक्के
३	मँगल (मँगनीज)	<u>2.५२</u>	२	** / जमिनीतून १० ते २५ किलो / हे मँगनीज सल्फेट किंवा फायरलीद्वारे ०.२५ टक्के
४	जरत (झिंक)	<u>0.28</u>	०.६०	** / जमिनीतून २५ ते ३० किलो / हे झिंक सल्फेट किंवा फायरलीद्वारे ०.४ टक्के

टिप : ** / पुरेसे असल्याने शिफारस नाही

:- प्रयोग शाळेचा पत्ता :-
कार्यालय : जिल्हा मृद सर्वेक्षण व
मृद चाचणी अधिकारी, परभणी
कल्याण नगर, डॉ.पुरी यांना भेटला, परभणी

जिल्हा मृद सर्वेक्षण व मृद चाचणी अधिकारी,
परभणी
अधिक माहितीसाठी कृपया मागे व्हा.....

III. APPLICATIONS OF ZEOLITES

Applications of zeolites in different fields depends upon the several physical or chemical properties including (i) ion – exchange (ii) adsorption (iii) dehydration and rehydration and (iv) Siliceous composition

भारत सरकार सेवाध्य (युक्त पोस्ट)
महाराष्ट्र शासन-कृषि विभाग
मृदा विश्लेषण अहवाल-विषय

प्र.शा.क्र. 228/ जा.क्र. दिनांक / /

शेतकऱ्याचे नाव :- श्री. पी. देवराज पोस्ट :-
पत्ता :- गांव :- पाली जिल्हा :- परभणी
तालुका :- मानवत जिल्हा :- परभणी
सर्वे नं. :- 284/D पुढील पिक :-

अ.क्र.	गुणधर्म	निरीक्षण (पी.पी.एम.)	सर्वसाधारण प्रमाण (पी.पी.एम.)	शिकारस
1	तांबे (कोपर)	9.48	0.2	** / जमिनीतून 90 ते 92 किलो / हे. कोपर सल्फेट किंवा फवारणीद्वारे 9 टक्के
2	लोह (आयन)	2.88	8.4	** / जमिनीतून 24 ते 30 किलो / हे. फेरस सल्फेट किंवा फवारणीद्वारे 0.4 टक्के
3	मँगल (मॅंगनीज)	2.98	2	** / जमिनीतून 90 ते 24 किलो / हे मॅंगनीज सल्फेट किंवा फवारणीद्वारे 0.24 टक्के
4	जस्ता (झिंक)	0.28	0.60	** / जमिनीतून 24 ते 30 किलो / हे झिंक सल्फेट किंवा फवारणीद्वारे 0.8 टक्के

टिप : ** / पुढे असल्याने शिकारस नाही

प्रयोग शाळेचा पत्ता :-
कार्यालय : जिल्हा मृदा सर्वेक्षण व मृदा चाचणी अधिकारी, परभणी
कल्याण नगर, डॉ.पुरी यांच्या बंगला, परभणी

जिल्हा मृदा सर्वेक्षण व मृदा चाचणी अधिकारी,
परभणी

अधिक माहितीसाठी कृपया पाहो.....

CONCLUSIONS

Natural zeolite Stilbite was collected from Ajanta caves. Characterization was made by XRD, FTIR, TG/DTA method. Stilbite was used in soil then result is reported there is increase in iron, increase in zinc, increase in calcium, decrease in cu. Which is best result for soil. Ion exchange properties of Stilbite plays important role in soil application

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