

RESEARCH ARTICLE

TG/DTA, TG DTA Characterization and Industrial Application of Heulandite & Stilbite brown Natural Zeolite Crystal

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ABSTRACT

Different kinds of papers are needed for various purposes. The developing country like India, having high growth rate population, demands large production of quality papers. Number of paper industries are established all over the world for the production of different papers such as, printing paper, writing paper, drawing paper, art paper, packing paper, tissue paper, crape paper, tracing paper, currency paper, daily newspaper, filter paper etc. Now a day papers are used for preparation of plates, cups, dishes and others. Waste wood, waste cotton cloth, and some other fillers are the basic materials usually used for production of all kind of papers. For the production of quality papers different chemicals are used as fillers, which are polluting the environment.

Zeolites are crystalline aluminosilicate mineral having skeletal structure, with well - defined voids and channels filled with considerable amount of water in it. Due to fascinating properties and presence of well - defined voids and channels, zeolite crystals have countless eco-friendly application in various fields. Natural zeolite crystals Stilbite brown and Heulandite brown collected from different parts of Maharashtra particularly from Marathwada region, quarries near Ajanta caves (Aurangabad) is used for this study.

All Zeolite crystals are grinded for less than 212 μ size and characterized for TG/DTA, TG DTA characterization. 10 % of each Zeolite powder is used as paper filler and papers are prepared, dried in sun light for seven days. Properties of paper on which the quality of the paper decided are studied. Results obtained are presented in this paper.

Key words: - Zeolite, filler Hosiery pulp (a pulp of waste cotton cloth), Handmade paper

INTRODUCTION

Zeolites are crystalline aluminosilicate mineral having skeletal structure, with well-defined voids and channels filled with considerable amount of water in it [1]. Due to fascinating properties and presence of well-defined voids and channels, zeolite crystals have countless eco-friendly applications in various fields, such as water treatment, aquaculture, agriculture, horticulture, odor control, ion exchange, gas adsorption, industrial gas separation, heat storage and solar refrigeration and others. Now a day hundred tons of Zeolite powder is being used in petrochemical and other industries, so Zeolite is becoming new advanced material in different fields for eco-friendly applications [2].

The developing country like India, having high growth rate population, demands large production of quality papers. Number of paper industries are established for the production of various kinds of papers, such as printing paper, writing paper, drawing paper, bond paper, art paper, packing paper, tissue paper, crape paper, tracing paper, currency paper, daily newspaper, filter paper, computer paper etc. Now a day papers are being used for preparation of plates, cups, dishes napkins and others.

Waste wood, waste cotton cloth, sugar cane waste and some other filler are the basic materials usually used for production of all kind of papers [3]. For the production of quality papers different chemicals are used as fillers, which are polluting the environment. Due to increasing demand of various papers, bad effects of chemicals it has been decided to study the impact of microcrystalline zeolite crystals on properties of hand made paper-hosiery pulp-in paper industry.

Table 1.1

Sr. No.	Properties of Handmade paper	Percentage of filler			Remark	
		1	2	3	1	2
		100% Hosiery pulp	10% stilbite Brown	10%Heulandite Brown	Stilbite brown	Heulandite brown
1.	Basis in Gm/m ²	126.51	124.98	127.02	-1.53	+0.51
2.	Burst Factor	15.57	18.96	14.56	+3.39	-1.01
3.	Breaking length in meters.	1950.75	1947.95	1638.35	-2.8	-312.4
4.	Tear factor	135.95	147.22	100.77	+11.27	-35.18
5.	Double fold	18.00	25.00	12.00	+7.00	-6.00
6.	Brightness %	80.3	80.7	79.3	+0.4	-1.00
7.	Opacity in %	89.3	88.5	88.6	-0.8	-0.77

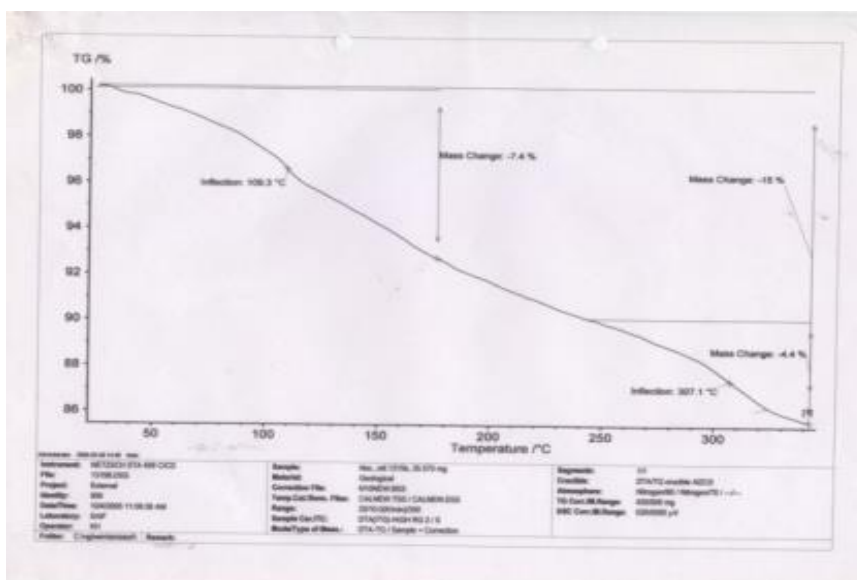
METHODOLOGY

Natural zeolite crystals, Stilbite brown, Heulandite brown collected from different parts of Maharashtra particularly from Marathwada region-quarries available near Ajanta caves (Aurangabad) has been tried for this study.

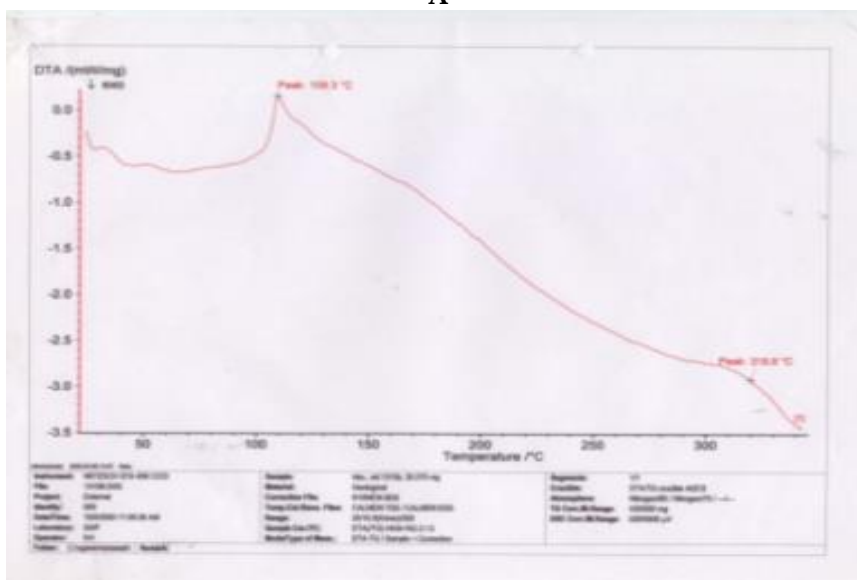
Above collected natural zeolite crystals are identified as zeolite by morphological character and pure zeolite crystals are separated from rocks- grinded for less than 212 μ size and characterized for Zeolitic nature by usual method TG/TGA analysis is done by NETZSCH STA 40/CD instrument in Nitrogen/90/Nitrogen/70 atmosphere at SAIF- IIT Chennai-25. 10 % of each Zeolite powder is used as paper filler in hosiery pulp (a pulp prepared from waste cotton cloth). Papers are prepared, dried in sunlight for seven days and properties of paper on which the quality of the paper decided are studied. Results obtained are presented in this paper.

RESULTS AND DISCUSSION

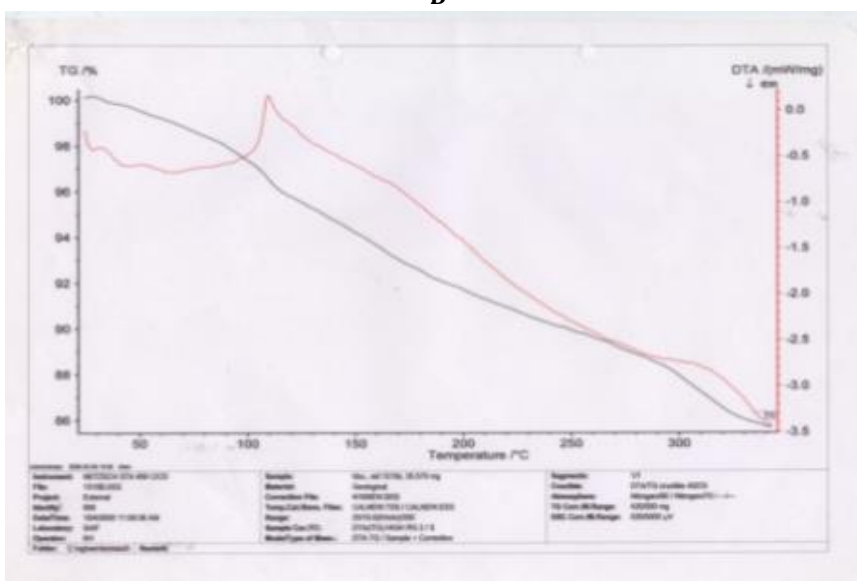
1. Basis weight in g/m² is increases by 0.5 gm/m².where as it is decreases by 1.53gm/m² due to addition of **Heulandite brown and Stilbite brown** filler respectively in Hosiery pulp paper.
2. Due addition of 10 % Stilbite brown and Heulandite brown natural Zeolite crystals in Hosiery pulp paper filler, Burst factor of this paper increased by 3.39 where as it is decreased by 1.01.
3. Breaking length in meters of Hosiery pulp paper decreases by 2.8 and 312.4 due to application of Stilbite brown and heulandites brown natural zeolite crystal.



A

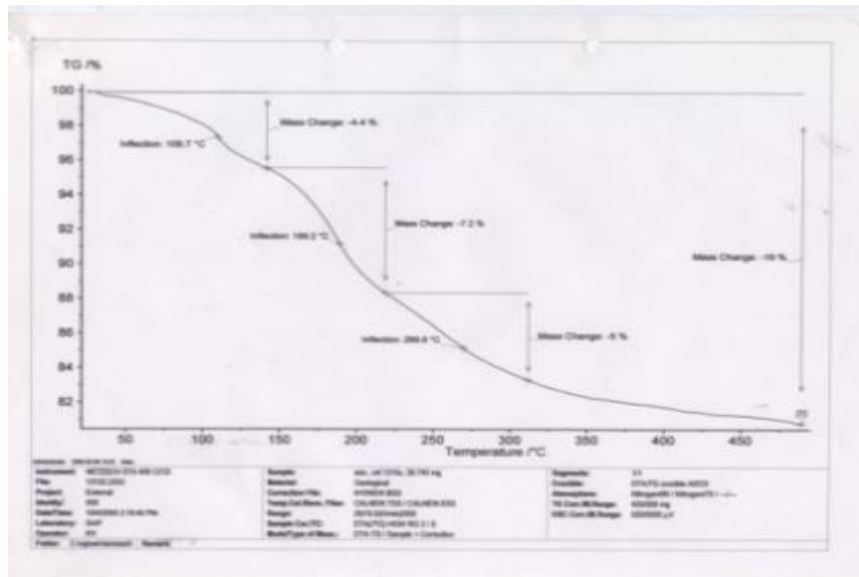


B

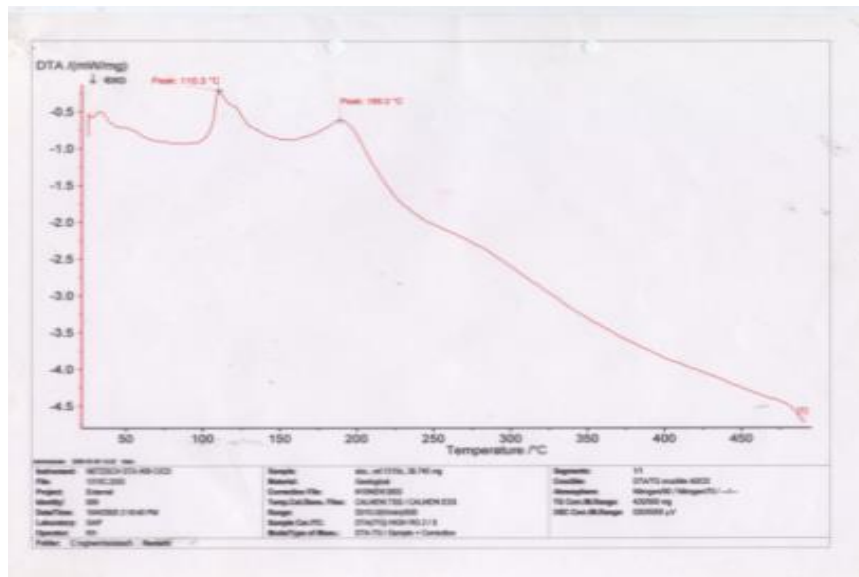


C

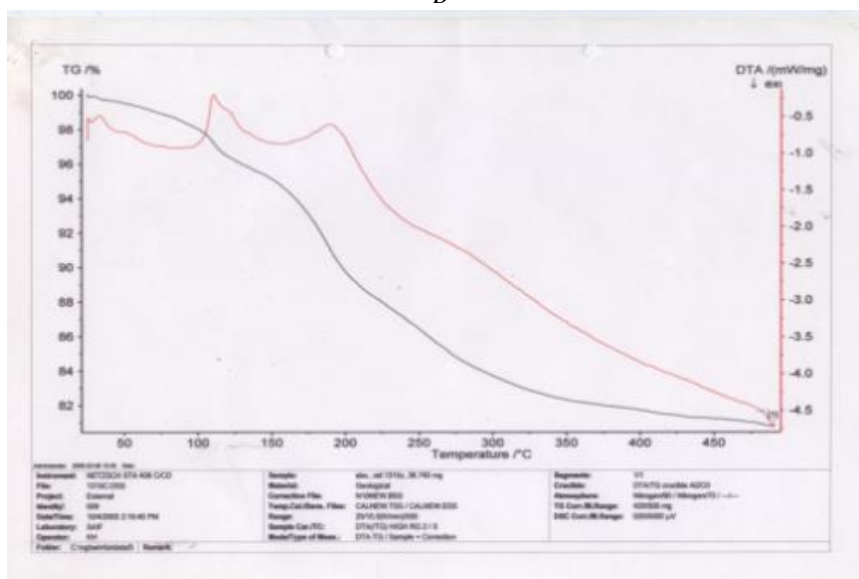
Fig.1 (A) TG/% Curve of Stilbite brown zeolite crystal (B) DTA/(mW/mg) Curve of Stilbite brown zeolite crystal (C) TG/% , DTA/(mW/mg) Curve of Stilbite brown zeolite crystal



A



B



C

Fig.2 (A) TG/% Curve of Heulandite brown zeolite crystal (B) DTA/(mW/mg) Curve of Heulandite brown zeolite crystal (C) TG/% ,DTA/(mW/mg) Curve of Heulandite brown zeolite crystal

4. Tear factor of handmade paper is increased by 11.27 & 35.18 respectively due to Stilbite brown and Heulandite brown filler.
 5. Double fold property of paper increases 7.00 & 6 by Stilbite bite brown and Heulandite brown Zeolite crystal.
 6. Brightness of Hosiery pulp paper is increases by 0.4 % where asdecreas by 1 % due to Stilbite brown and Heulandite brown fillerrespectively.
 7. Opacity of Hosiery pulp paper decreases 0.8 % & 0.77 % by of Stilbite brown and Heulandite brown fillerrespectively.
 8. Strong peak in DTA curve is observed at 109.3^o c, 110. 3^o c, where as small peak is observed at 319.8^o c, 189.2^o c respectively for Heulandite and stilbite brown crystal.
 9. Inflection is observed at 109. 3^o c, 307.1^o c for Heulandite brown crystal and it obtained at 109.7^o c, 189.20 c, and 269.80 c for stilbite brown crystal.
3. Natural Zeolite crystals stilbite brown and Heulandite brown can be used as paper filler in handmade paper – Hosiery pulp in paper industry, without any chemicals.

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Conflicts of interest: The authors stated that no conflicts of interest.

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CONCLUSION

1. Strong and weak peaks are observed in both crystals
2. There is slow decrease in mass for increasing temperature for both natural zeolite crystals.

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