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Determining the efficiency of zeolite in eliminating the smell of tobacco

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1. Introduction and study objectives

Apart from the obvious and well-documented damage that smoking brings to the smoker's health, one of the biggest disadvantages of smoking is the smell it creates and, consequently, leaves behind. Tobacco smoke is an aerosol produced by the incomplete burning of tobacco while smoking cigarettes and other tobacco products. Tobacco smoke contains a number of toxicological chemicals such as: polycyclic aromatic hydrocarbons (benzopyrene), tobacco-specific nitrosamines (NNK, NNN), aldehydes (acrolein, formaldehyde), carbon monoxide, hydrogen cyanide, nitrogen oxides, benzene , toluene, phenols (phenol, cresol), aromatic amines (nicotine, ABP (4-Aminobiphenyl)) and harmala alkaloids. [3] The radioactive element polonium-210 is also known to occur in tobacco smoke. [1] The chemical composition of the smoke depends on the frequency, intensity, volume and duration of the puff at various stages of cigarette consumption. [4] The purpose of the study is to evaluate the efficiency of zeolite in eliminating the tobacco smell buy evaluating the total PAH and the burning gasses.

2. Methodology

Laboratory scale rooms were made of glass aquariums, with a volume of 54 l and dimensions LxWxD 60x30x30 cm, to which were added, by sealing with silicone, Plexiglas which has a cutout with dimensions of 15x15 cm. A cover was made with a sealing gasket with dimensions 1.5 cm larger than the cutout that was fixed in plexiglass with screws so that the whole assembly can be sealed. The dimensions of the cutout allow the easy introduction of both tobacco and zeolites. (Figs. 1 and 2). Also, 2 holes were made for sampling on the filter which were sealed until the time of sampling and, after sampling, with adhesive tape.

Fig. 1 Cover with gasket and fixing with screws

Fig. 2 Waterproof chamber with a volume of 54 l

Fig. 3 Activated zeolites used in experiments

A sealed chamber was considered a control, and no zeolite was introduced into it. In the rest of the sealed chambers, 5 grams of zeolites of different granulations were introduced which were activated by different treatments (calcination, acid and basic) (fig. 3): • Zeolite of dimensions 1-3 mm, activated by calcination; • Zeolite of 3-5 mm dimensions, activated by basic treatment. The tobacco used in the experiments is Silverado Blue Extra Volume tobacco, being a voluminous tobacco, of superior quality, which was cut into strands and purchased from specialty stores. It does not contain artificial flavors and the strength is medium to strong. Ignition gel used in the food industry for the HORECA field was used to maintain combustion. 5 grams of tobacco were burned inside each airtight chamber. Measurements were made for the sample / control chamber and measurements for each type of zeolite. The analysis of polycyclic aromatic hydrocarbons from the bottom of the test chamber was also performed to demonstrate that the polycyclic aromatic hydrocarbons quantified following the analysis performed on the ECO-ODOR zeolitic material are due / results largely to the adsorption process and not to the deposition process. on zeolites. The results obtained from the chamber containing the zeolite samples will be compared with the results obtained from the sample / control chamber.

►Flue gas analysis: Flue gas analysis was performed directly by reading from the screen of the portable gas analyzer equipment, model GA5000, Manufacturer: GEOTECH

►Analysis of polycyclic aromatic hydrocarbons: An extraction of both the filter and the chopsticks and the zeolites was performed with 25 ml of hexane as extraction solvent. The mixture of extraction solvent and sample was placed on an ultrasonic bath for 30 minutes so as to ensure optimal extraction. After filtration the extract was concentrated to dryness using a vacuum steam wheel. The extract was returned with 1 ml of acetonitrile.

The sample thus obtained was injected into high pressure liquid chromatograph with HPLC-FLD fluorescence detector, Perkin Elmer Series 200 in order to quantify the following polycyclic aromatic hydrocarbons (PAHs): acenaften, antracen, benzo (a) antracen, benzo (a) piren, benzo (b) fluoranten, benzo (k) fluoranten, benzo (ghi) pirilen, crisen, dibenzo (a, h) antracen, fenantren, fluoren, fluoranten , indene (1,2,3-cd) pyrene, naphthalene, pyrene.

3. Results and conclusions

- **No significant difference was recorded between the flue gases measured for each experiment, which shows that the values obtained for PAHs in the control sample can be used for comparison with the samples in which zeolite with different characteristics was introduced into the sealed chamber. .**
- **In the control sample, the amount of PAHs deposited on the wall is higher than in the samples with zeolites, 20.74 ng / cm2 compared to 2.73-3.38 ng / cm2 in the samples with zeolites but significantly lower than the amount adsorbed by zeolites. This demonstrates that zeolites have the ability to adsorb PAHs and thus have the ability to purify the air in smoking rooms. The large difference between the amount on the bottom of the chamber in which zeolites were not introduced and the amount in which zeolites were introduced is due to the capacity and degree of adsorption of PAHs by zeolites.**
- **There is a significant difference between the amount of PAHs quantified on the PM10 filter in the control sample compared to the samples in which zeolites with different characteristics were introduced, 75.69 ng / m3 compared to 1.82-3.42 ng / m3.**
- **The zeolite with dimensions of 3-5 mm activated by basic treatment adsorbed in total the highest amount of polycyclic aromatic hydrocarbons, namely 89.56 ng / g.**
- **The smallest amount of PAH was adsorbed by zeolite with dimensions 1-3 mm, activated by calcination, 38.92 ng / g.Table 2** Results of Aflatoxin B1 determination

References
1. Robert Kapp (2005), "Tobacco Smoke", Encyclopedia of Toxicology, Volume 4 (2nd ed.), Elsevier, pp. 200–202, ISBN 978-0-12-745354-5
2. Ken Podraza (29–30 October 2001), Basic Principles of Cigarette Design and Function (PDF), Philip Morris USA
3. "Harmala Alkaloid". Science Direct. Elsevier B.V. Retrieved 26 November 2017.
4. The Health Consequences of Smoking: The Changing Cigarette (PDF), U.S. Dept. of Health and Human Services, p. 49

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