REMOVAL OF SUNSET YELLOW FCF FROM AQUEOUS SOLUTIONS USING MODIFIED NaX ZEOLITE AND MCM-41 SILICA OBTAINED FROM FLY ASH

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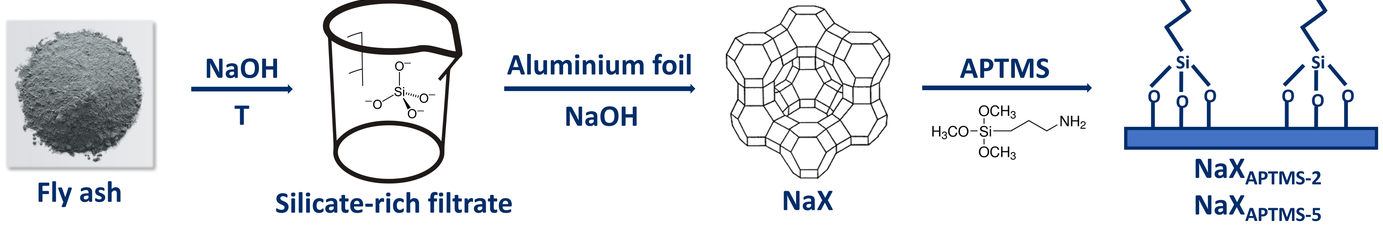
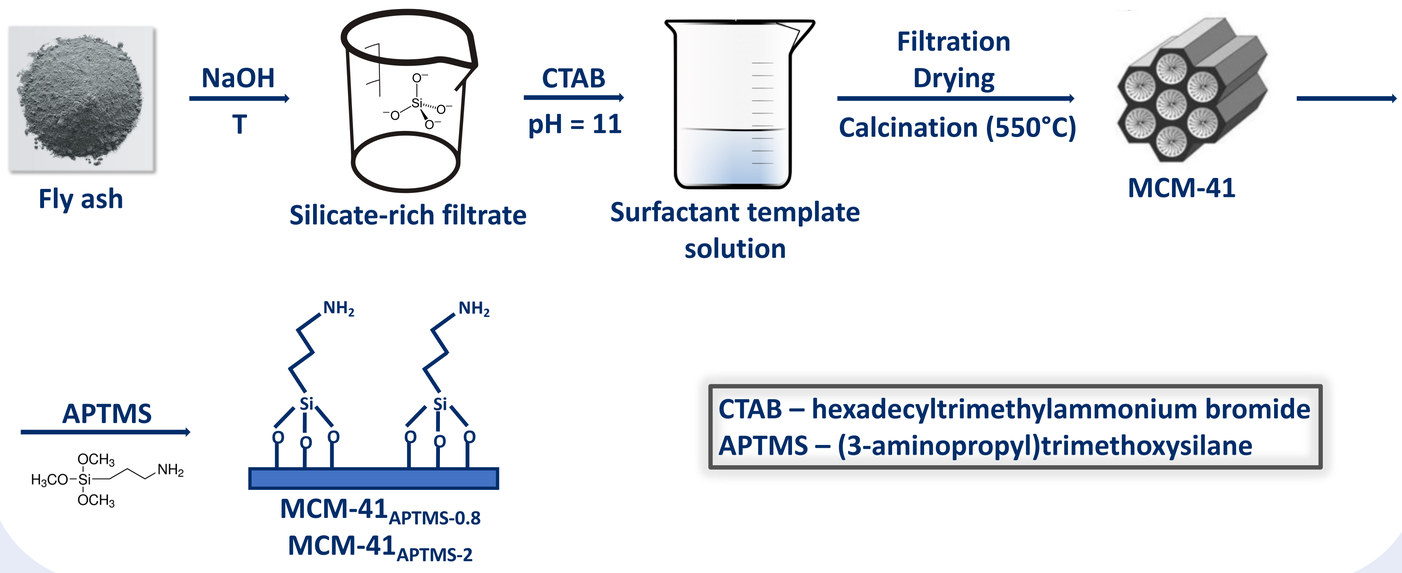
The economic development of the world has contributed to a significant deterioration of the environment. Water bodies are polluted with various compounds, including organic dyes, that threaten wildlife and human health. These contaminants are difficult to remove *via* conventional methods such as mechanical and biological treatment, chemical coagulation or sludge digestion, hence adsorption processes are most often used. For this reason, it is important to search for new porous adsorbents that would effectively remove dangerous substances from water. Fly ash is a solid residue obtained from the energetic combustion of coal in power plants and thermal power plants. The wide range of its applications is related to its characteristic physicochemical properties (such as chemical composition, bulk density, particle size, porosity, water holding capacity or specific surface area). Therefore, fly ash is currently used in the synthesis of zeolites and ordered mesoporous silicas.

NaX SYNTHESIS



MCM-41 SYNTHESIS



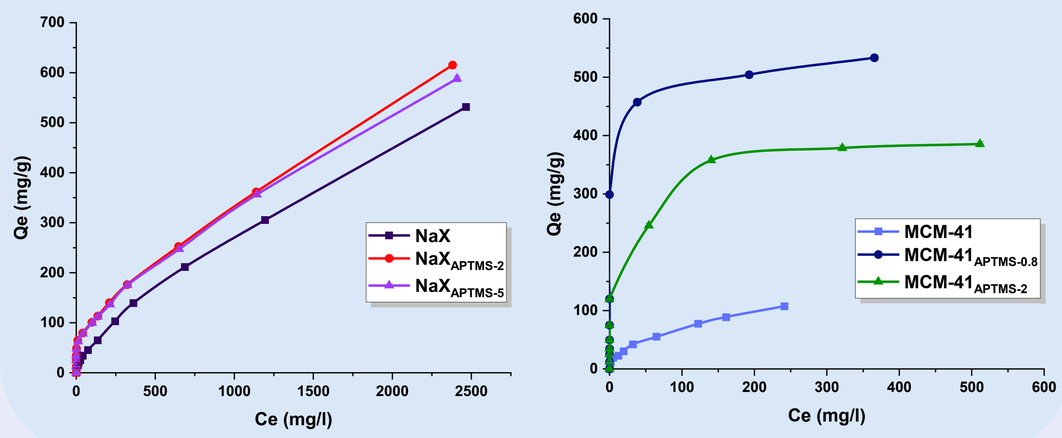
CTAB – hexadecyltrimethylammonium bromide
APTMS – (3-aminopropyl)trimethoxysilane

The amount of Sunset Yellow FCF adsorbed on the surface of pure and modified materials was calculated by the formula:

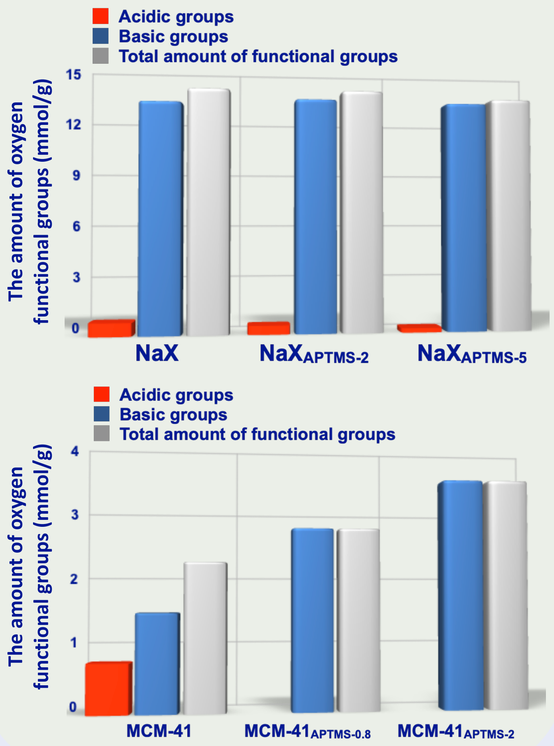
$$Qe = \frac{(C_0 - C_e) \times V}{m}$$

Q_e – the adsortpion capacity of the adsorbent (mg/g)
C_0 – the initial concentration of Sunset Yellow FCF solution (mg/l)
C_e – the residual concentration of Sunset Yellow FCF solution (mg/l)
V – the volume of Sunset Yellow FCF solution (l)
m – the mass of the adsorbent (g)

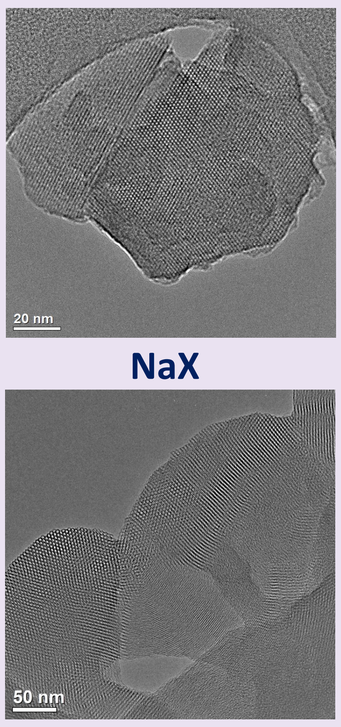
ADSORPTION ISOTHERMS OF SUNSET YELLOW FCF



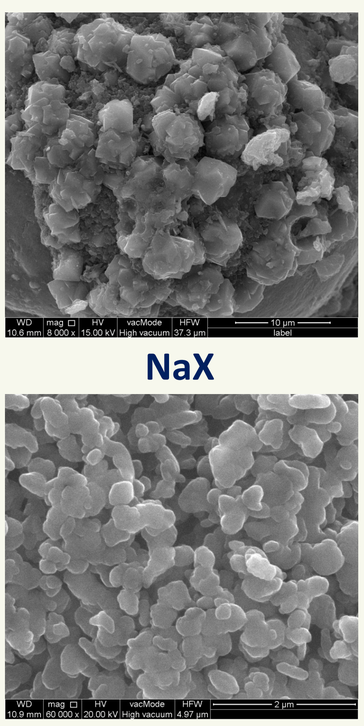
ACID-BASE PROPERTIES



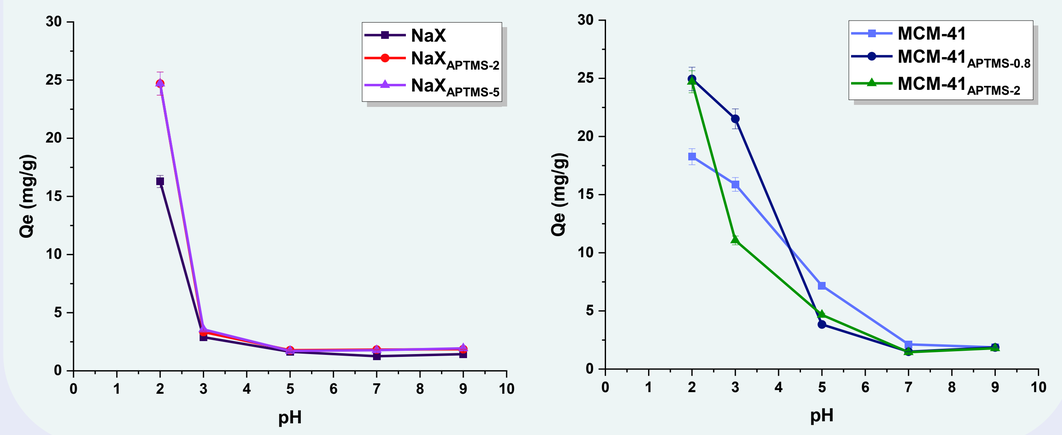
TEM IMAGES



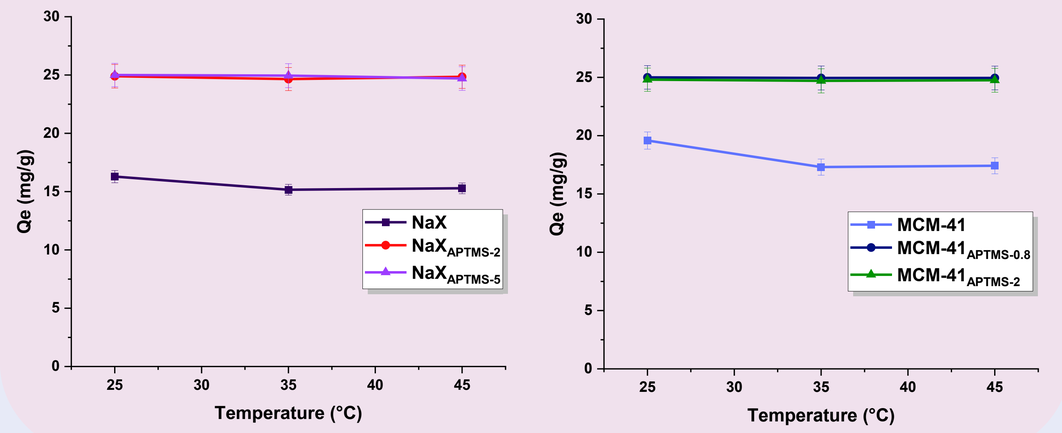
SEM IMAGES



pH EFFECT



TEMPERATURE EFFECT



ADSORPTION STUDIES

Adsorption conditions:

- The amount of the adsorbent: 50 mg
- The concentrations of Sunset Yellow FCF solutions: 12.5-3000 mg/l
- The volume of Sunset Yellow FCF solution: 50 ml
- Time: 24 hours
- The wavelength of maximum absorbance for Sunset Yellow FCF: 483 nm

The pH value and the temperature of the adsorption process as well as the acid-base properties of studied zeolites and silicas have a significant influence on their sorption capacities towards Sunset Yellow FCF. The best results were obtained at room temperature in acidic environment what arise from the exothermic nature of the process and electrostatic attraction between Sunset Yellow FCF molecules and adsorbents. Research proved that the modified NaX and MCM-41 can effectively remove the analyzed azo dye from aqueous solutions and are promising adsorbents for other pollutants endangering the environment.