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HR EXCELLENCE IN RESEARCH

REDUCING THE IMPACT OF TOXIC CHEMICALS ON THE ENVIRONMENT AND HEALTH THROUGH THE USE OF ADSORBENTS AND CATALYSTS OBTAINED FROM LOCAL RAW MATERIAL (20.80009.7007.21)

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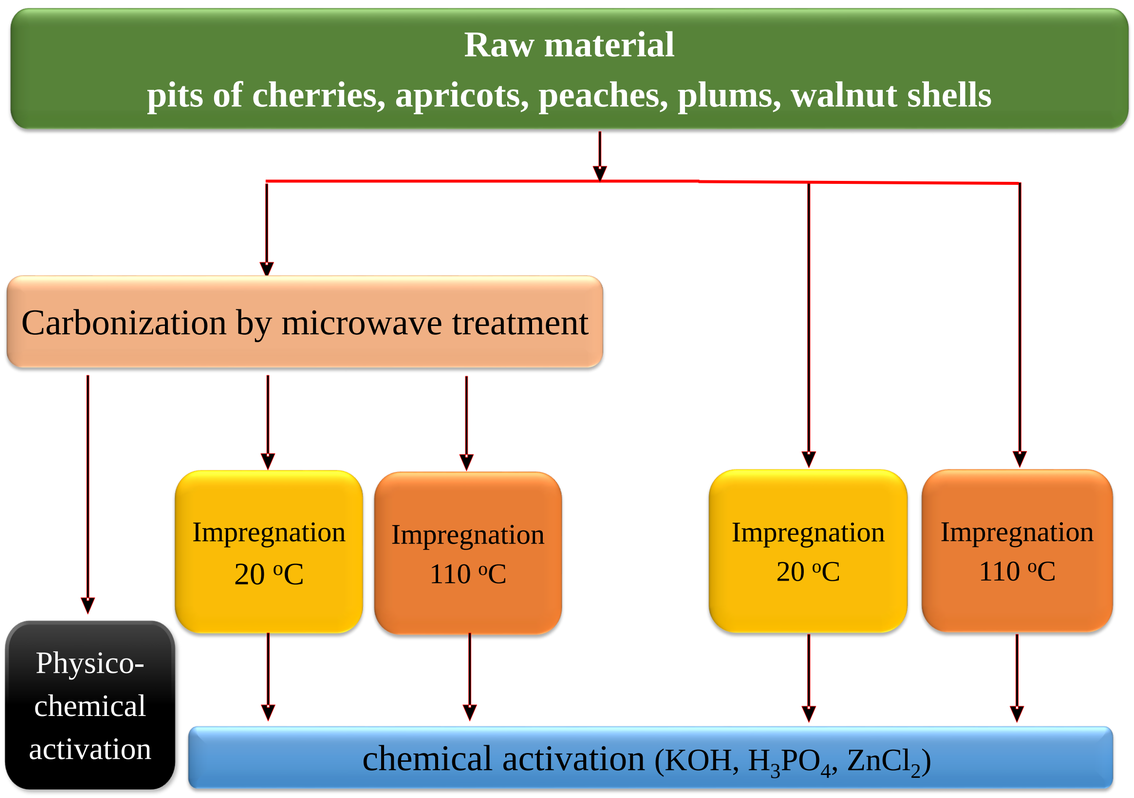
APPLICATION FIELDS: Environment - Pollution Control

AIM: reducing environmental pollution as a result of harmful anthropogenic activity; rational use and capitalization of local mineral resources; improving the quality of water and soils by reducing pollution following the discharge of wastewater into the outfall or into the natural environment; wastewater treatment technologies for the purpose of protecting surface and underground waters.

I. Synthesis of activated carbons through microwave treatment



Carbon adsorbents were synthesized from various local raw materials (walnut shells, stones of plum, peaches and cherry) by microwave treatment using steam, phosphoric acid, zinc chloride and potassium hydroxide as activating agents. The optimal activation conditions were established: microwave power, activation time, raw material / activating agent ratio. Microwave treatment of biomass impregnated with potassium hydroxide allows obtaining activated carbons with increased specific surfaces (1600-1800 m2/g), having a predominantly microporous structure. Phosphoric acid allows obtaining activated carbons with a mixed pore structure, while preserving the morphology of the raw material.

CA	Raw Material	impregnation parameters	η, %	η_T, %	S_{BET}, m^2/g	V_s, cm^3/g	V_{mi}, %	$V_s(C_6H_6)$, cm^3/g
CAN-1K	walnut shells	Raw Material /Activating Agent Ratio=1/4 Contact temperature= 110 °C Contact time= 24 h	2,2	2,2	**1674**	1,207	48,9	0,917
CAN-2K	Carbonized walnut shells		69,2	20,0	1315	0,622	83,6	0,625
CAN-3K	plum pits		8,2	8,2	1320	1,100	30,0	1,445
CAN-4K	Carbonized plum pits		83,4	23,2	1083	0,501	81,8	0,516

II. Synthesis of carbonic adsorbents by the fluidized bed activation method

A series of activated carbons with a predominantly mesoporous structure was obtained from apricot kernel shells and walnut shells. The optimal activation conditions (temperature, time, particle size of the raw material, mass of the activating agent) were determined for each type of raw material.

AC	S_{BET}, m^2/g	V_{mi}, cm^3/g	V_{me}, cm^3/g	V_t, cm^3/g	V_{me}, %
AC-MR	**2018**	0.569	1.004	1.573	63.8
AC-C3	1424	0.332	0.684	1.016	67.3
AC-C	1385	0,341	0,602	0,943	63,8
AC-N	1186	0,284	0,510	0,794	64,2

III. Synthesis of activated carbons and catalysts using the hydrothermal method

The optimal conditions for obtaining carbon adsorbents from local raw materials by hydrothermal activation method were established. Adsorbents obtained by the hydrothermal method are characterized by specific properties, making it possible to impregnate them with heteroatoms or metal ions at low temperatures, as a result the process efficiency increases and energy consumption is reduced. Thus, the synthesized adsorbents also have catalytic properties which allows their use in the process of drinking water in order to eliminate nitrites, hydrogen sulfide, iron (II) and manganese (II). 6 samples of carbon adsorbents impregnated with Mn, Co and Cu ions were obtained by the hydrothermal activation method. The hydrothermal activation took place at 260 °C for three hours after reaching the temperature at a self-generated pressure of 4.5 MPa, with a nut shell: water mass ratio of 1:4.

IV. Testing of new materials (adsorbents, catalysts) under dynamic conditions at semi-pilot scale in water treatment processes

Dynamic testing of the efficiency of drinking water processes was performed on a model water sample containing a series of pollutants spread in the Republic of Moldova: nitrate ions, sulfate, iron, ammonium, calcium and a series of samples of real water collected from the com Pănășești, Strășeni district, Sculeni commune, Ungheni district and Coșcodeni village, Singerei district.
Experimental data were obtained regarding the efficiency of using of some procedures: aeration processes, oxidation, adsorption on activated carbons obtained in the laboratory, ion exchange, reverse osmosis in the process of drinking model water. The study of the chemical composition of groundwater and mine wells highlights the fact that only 7% of them comply with the sanitary norms imposed for drinking water

IMPLEMENTATION STAGE: implementation in local enterprises

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