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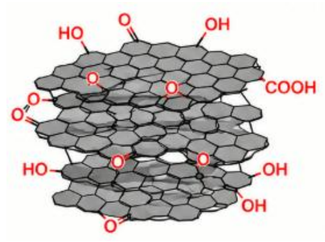

Graphene Oxide (GO) Layers

The influence of organic pollutants in wastewater on the results of the thermogravimetric analysis of graphene C-sorbents

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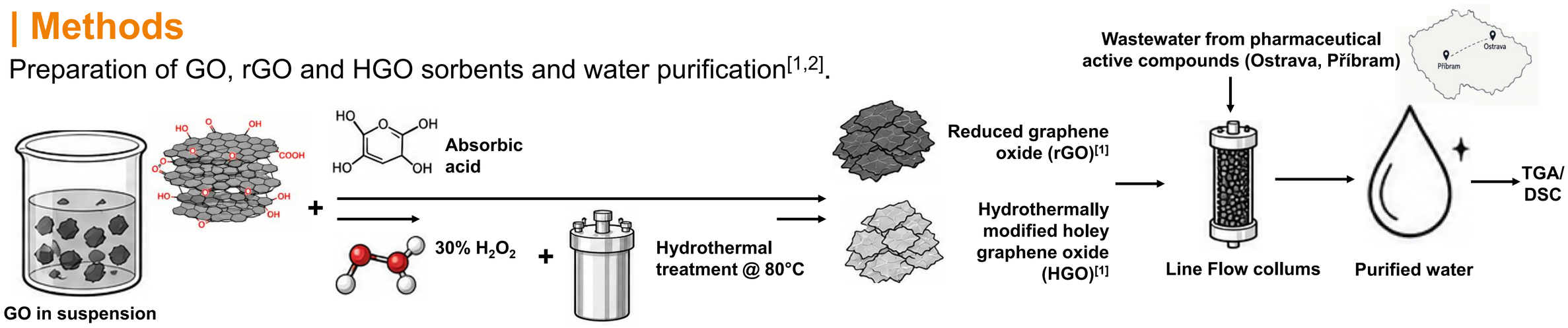
| Introduction

Many compounds of pharmaceutical contaminants are only partially removed by conventional wastewater treatment; therefore, they are released into receiving aquatic environments contributing to chronic ecological effects and the increase of the chemical burden on aquatic systems. In this context, the aim of the work is to study the influence of residual pharmaceutical pollutants on the thermal behavior of graphene-based sorbents in the polishing treatment of effluents from wastewater (WW) treatment plants located in Ostrava and Příbram, Czechia. Ultimately through Thermogravimetric Analysis and Differential Scanning Calorimetry (TGA/DSC) determine if they are suitable tools for distinguishing adsorption behavior and the effects on thermal stability and oxidation caused by the chemical composition of wastewater pollutants and graphene-based sorbents.

| Methods

Preparation of GO, rGO and HGO sorbents and water purification[1,2].



| Results

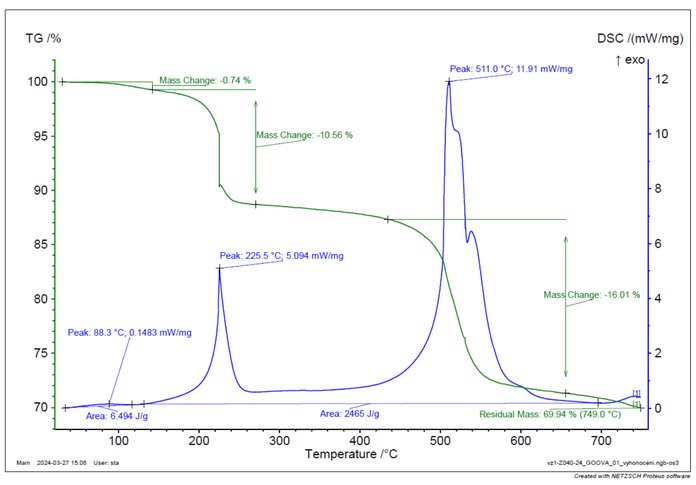


Fig 1. TGA with the DSC analysis for GO, Ostrava

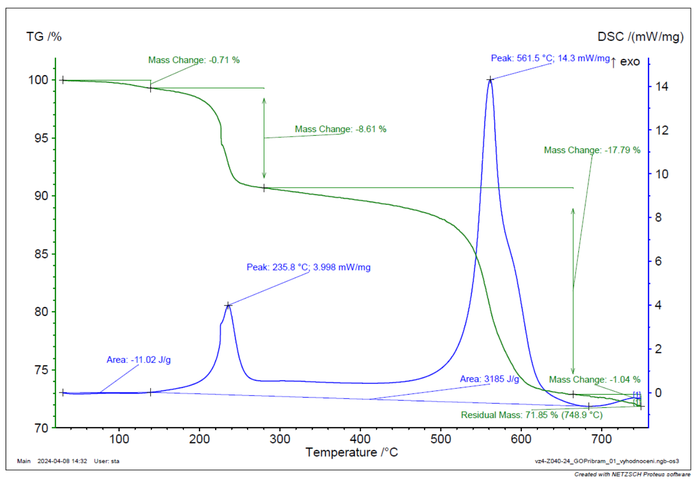


Fig 2. TGA with the DSC analysis for GO, Příbram

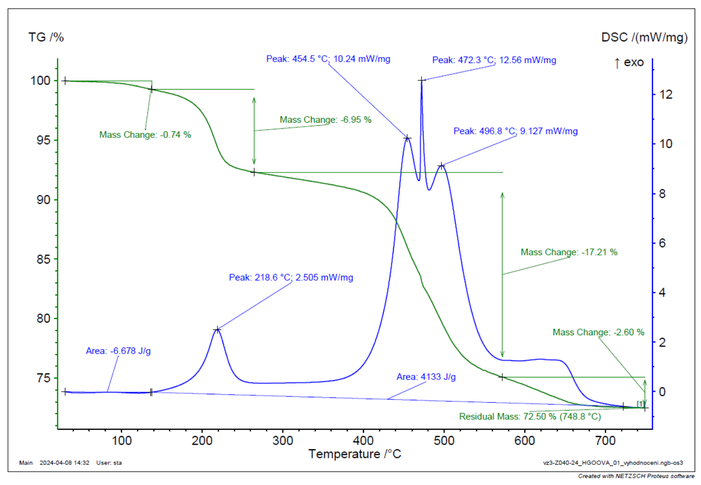


Fig 3. TGA with the DSC analysis for HGO, Ostrava

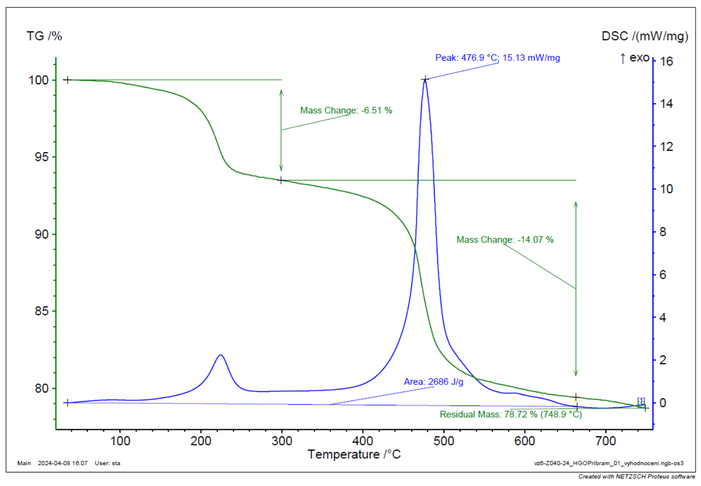


Fig 4. TGA with the DSC analysis for HGO, Příbram

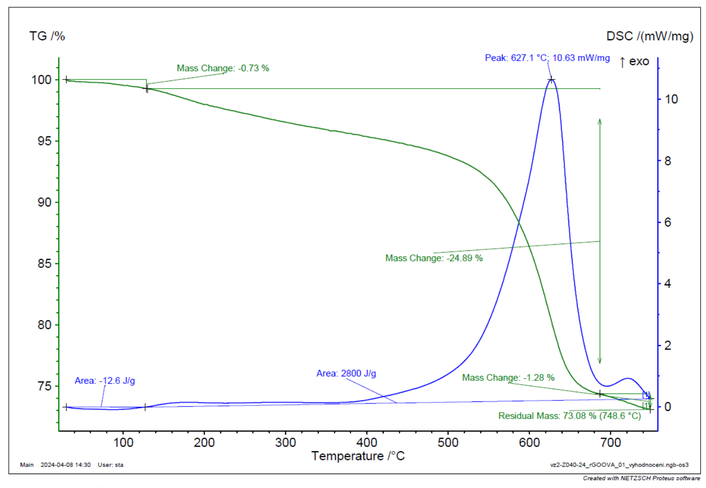


Fig 5. TGA with the DSC analysis for rGO, Ostrava

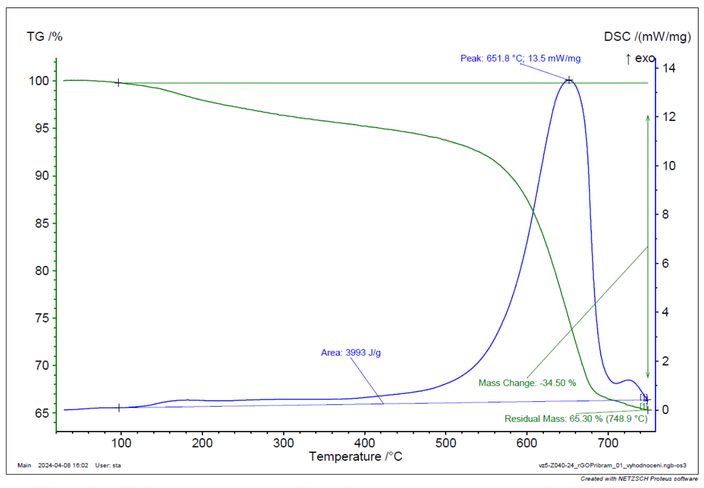


Fig 6. TGA with the DSC analysis for rGO, Příbram

Table 1. Overview of the physicochemical parameters determined from the thermal analysis spectra

WW origin, Sorbent	I EXO EFFECTS		II EXO EFFECTS	
	Peak temperature °C /ΔH mW/mg	Mass loss %	Peak temperature °C/ΔH mW/mg	Mass loss %
Ostrava, GO	225	10.56	511.0; 531.0; 550.0	16.01
	5.094		11.91	
Příbram, GO	235.8	8.61	561.5	17.70
	3.998		14.3	
Ostrava, HGO	218.6	6.95	454; 472; 496	17.21
	2.505		10.24; 12.56; 9.127	
Příbram, HGO	220	6.51	476.9	14.07
	2.15		15.13	
Ostrava, rGO	-	-	627.1	24.89
	-		10.63	
Příbram, rGO	-	-	651.8	34.5
	-		13.5	

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Functional groups. The adsorption behaviour of GO, rGO and HGO is governed by their surface chemistry and structural characteristics, with GO and HGO favouring polar pharmaceuticals through oxygen-containing functional groups, while rGO preferentially adsorbs aromatic and hydrophobic compounds via π-π interactions. [3,4,5]

| Conclusion

- The pollutant's composition and sorption capabilities of the sorbents differed in the two WW sources.
- Exo peaks and temperature profiles differences depended on the type of sorbent and the composition of the pollutants in the WW.
- GO and HGO exhibited the higher sorption of pollutants from the Ostrava WW, while rGO sorbed more pollutants from the Příbram WW.
- Pollutants with significant functional groups have the potential to cause the splitting of the exo peaks.
- It is possible to select sorbents for the removal of specific substances.