

Hybrid composites for the removal of Rhodamine 6G dye from aqueous solution

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INTRODUCTION

Sorbents are widely used to removal some classes of chemical pollutants from industrial water, particularly those are scarcely destroyed in conventional wastewater treatment plants. Dyes are serious issues because they are discharged into wastewater from several types of industries (textile finishing and dye manufacturing). The adsorption process offers alternative for the treatment of contaminated water, at the expense of low-cost and high performance adsorbents.

AIM
Development of synthesis approaches and optimization of the most favourable conditions to obtain hybrid materials with different ratio on the basis of inorganic (SiO₂) and organic (polymer) components by sol-gel method; investigation of their composition, the structure, and the adsorption properties to Rhodamine 6G dye from aqueous solutions.

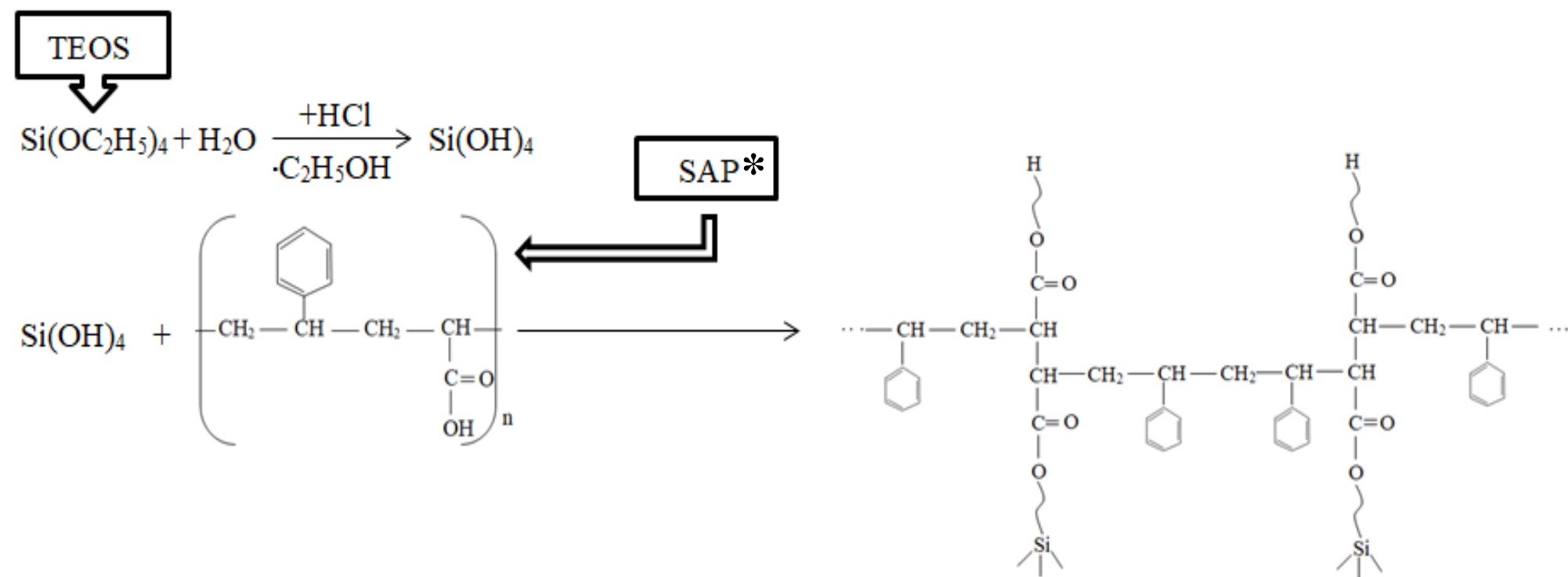
MATERIALS AND METHODS

Three composites with various ratios silica/polymer 5/1, 10/1, and 20/1 were synthesized by one-step sol-gel method. For inorganic precursor part produce tetraethyl orthosilicate (TEOS) was used as precursor and as an organic one - styrene-acrylic polymer Tubifast 4010 ®. The syntheses were realized by a one-step sol-gel method. The composition and structure of the hybrid materials were determined by CNHS analysis, acid-base titration, zeta potential measuring, IR spectroscopy, TGA, low-temperature nitrogen adsorption method and SEM.

SYNTHESIS AND CHARACTERISATION OF HYBRID COMPOSITES

Table 1. Characteristics of the samples

Synthesis



* styrene-acrylic polymer (SAP)

Fig 1. Scheme of hybrid composites synthesis

Sample	Elemental analysis data, mass. %		EDX, wt %	pI	C _{acid} , mmol/g	S _{sp} , m ² /g	V _{total} , cm ³ /g	d _{BJH} , nm
	C, %	H, %	Si, %					
TSAM 5/1	15	3.0	35.2	2.8	1.62	399	0.824	6.6
TSAM 10/1	9.5	2.7	41.6	2.7	1.76	497	0.850	5.7
TSAM 20/1	5.3	2.2	44.7	2.6	1.44	548	1.049	6.6

SEM

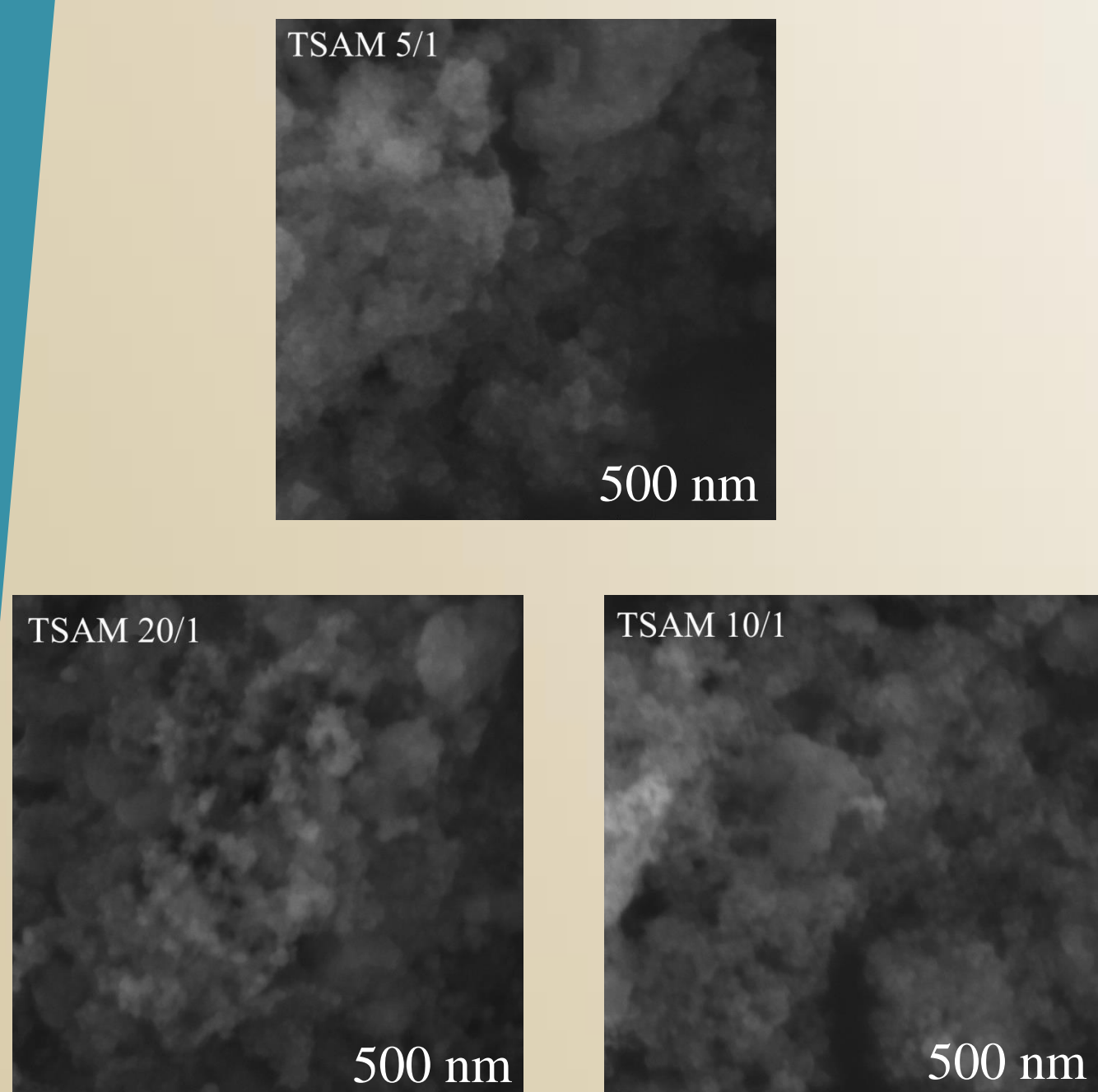


Fig 2. SEM images of hybrid materials

ADSORPTION STUDY OF RHODAMINE 6G

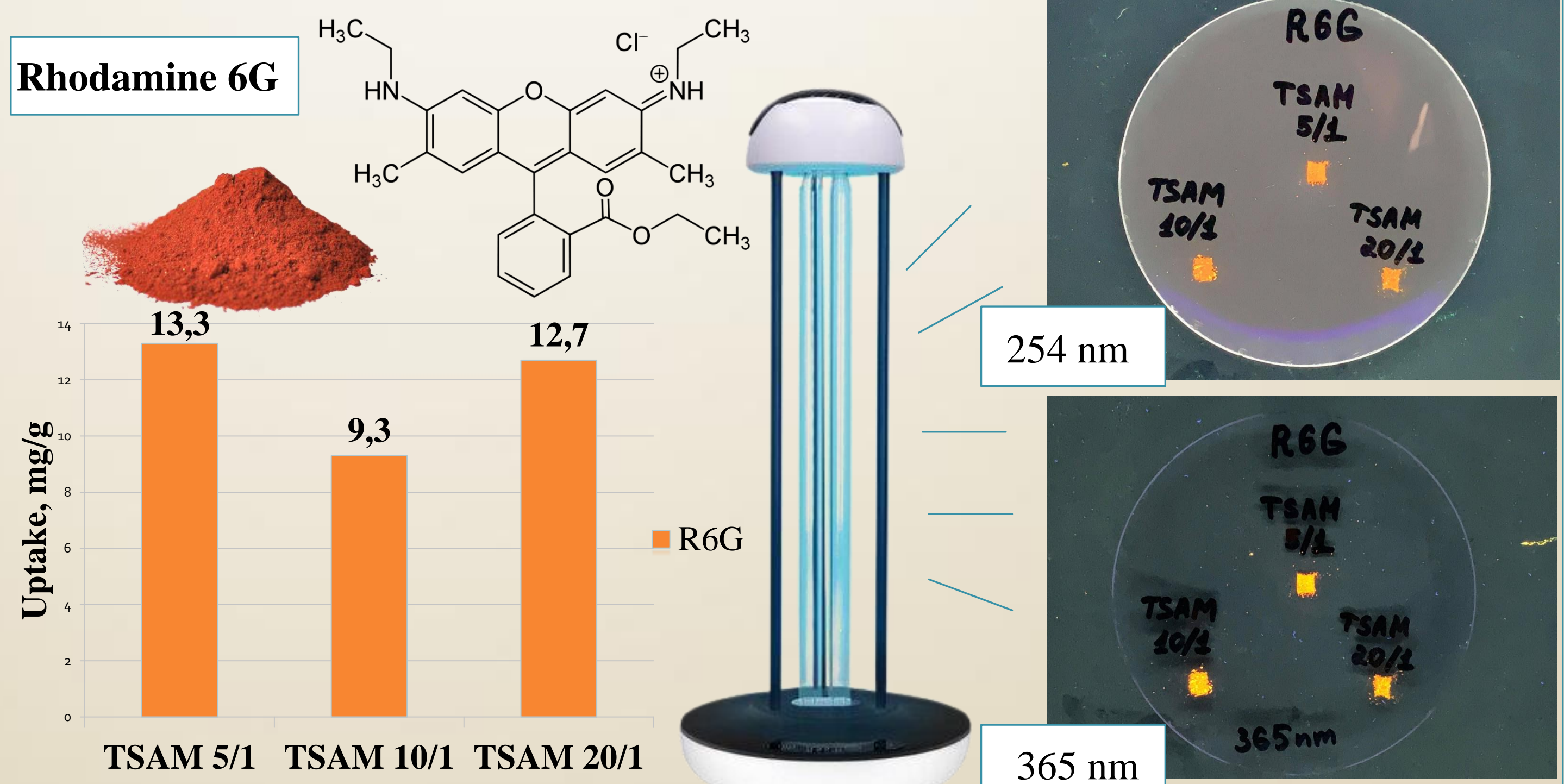


Fig 3. Results of the initial adsorption test of R6G

CONCLUSIONS

The composition and structure of new composites were investigated by the number of physico-chemical methods. Infrared spectroscopy confirmed the formation of Si-O-Si bonds, the presence of polymer in the silica matrix, and the interaction between organic and inorganic components as well as the presence of functional groups owned by the

composites. It was established that the synthesized materials had acid groups on the surface in the range of 1.44 – 1.76 mmol/g, the values of isoelectric point are at pH = 2.6 – 2.8, high specific surface area (399-548 m²/g).

The results demonstrated that the hybrid composites could be potentially as adsorbents for R6G removal.

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