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Natural zeolites supported green synthesized CeO_2@Polybenzimidazole hybrid materials for dye degradation

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INTRODUCTION & AIM

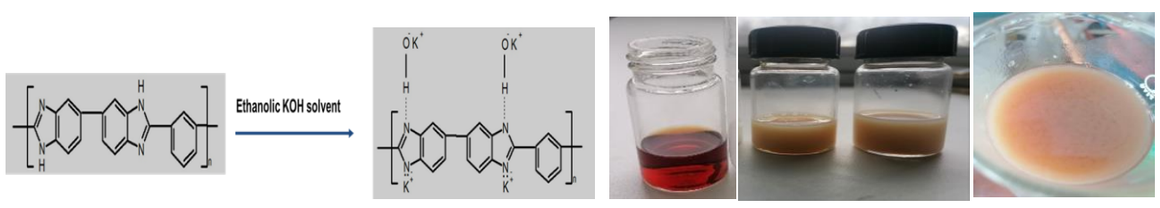
This work concerns the synthesis of zeolitized tuffs supported green synthesized CeO_2@Polybenzimidazole hybrid materials. The zeolitized tuffs, containing clinoptilolite (from deposit in Golobradovo, Bulgaria) and mordenite (from the deposit at the village of Lyaskovets, Bulgaria) are used as raw materials.

Study the structure, thermal behavior, phase and chemical composition of prepared hybrid composites using FTIR spectroscopy, Thermogravimetric analyses, PXRD and XRF.

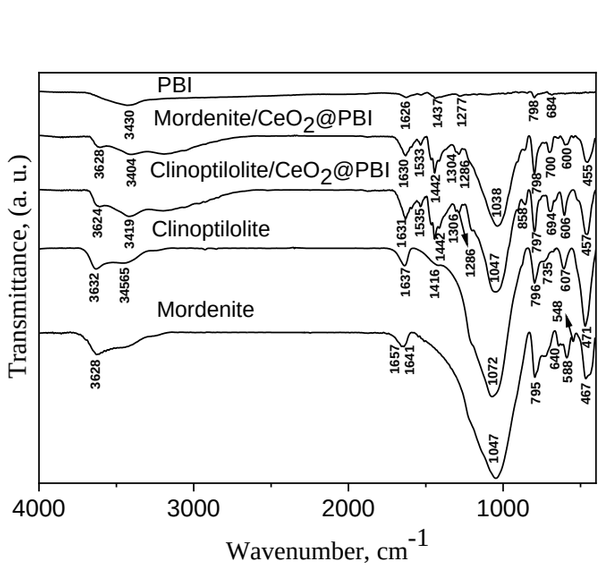
The clinoptilolite or mordenite tuffs supported green synthesized CeO_2@Polybenzimidazole are investigated as potential photocatalysts for Reactive Black 5 (RB5) dye degradation from aqueous solutions as model pollutant.

SYNTHESIS & PHOTOCATALYTIC STUDY

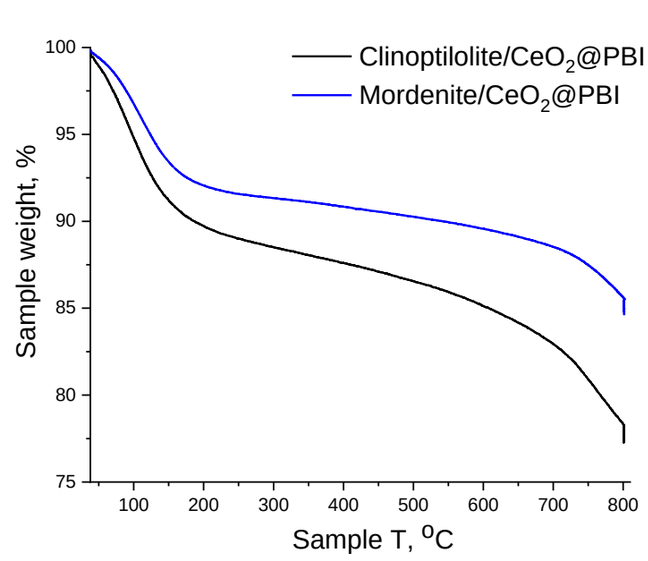
The natural zeolites - clinoptilolite from Golobradovo deposit, Bulgaria and mordenite from Lyaskovets deposit in Eastern Rhodopes, Bulgaria were used for preparation of natural zeolites supported CeO_2@Polybenzimidazole (PBI) hybrid materials with incorporated green synthesized ceria using Veronica officinalis L. plant extract and ethanolic KOH PBI as dispersing media:



The photocatalytic ability of prepared composites was tested for degradation of Reactive Black 5 (RB5) dye as model contaminant in aqueous solution (5 ppm) under UV-light.



FTIR spectra of the clinoptilolite and mordenite tuffs, PBI, clinoptilolite/CeO_2@PBI, mordenite/CeO_2@PBI.

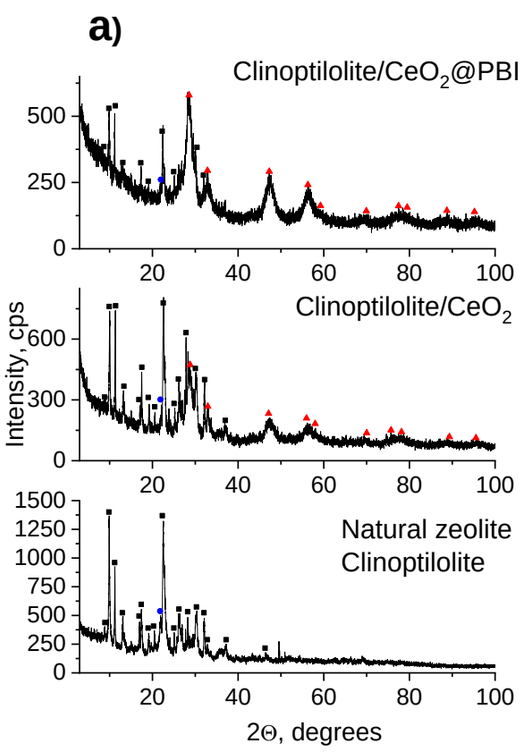


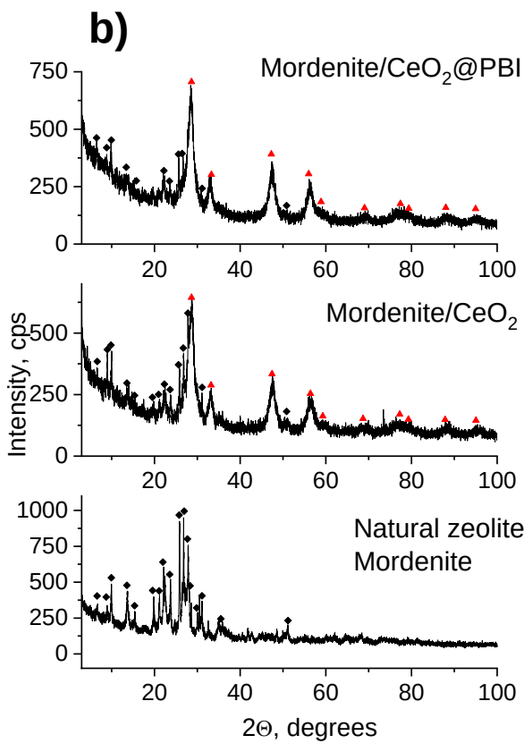
TG curves of the clinoptilolite/CeO_2@PBI, mordenite/CeO_2@PBI.

Chemical composition (wt.%) of zeolitized tuffs supported green synthesized CeO_2@PBI hybrid materials determined by XRF analysis.

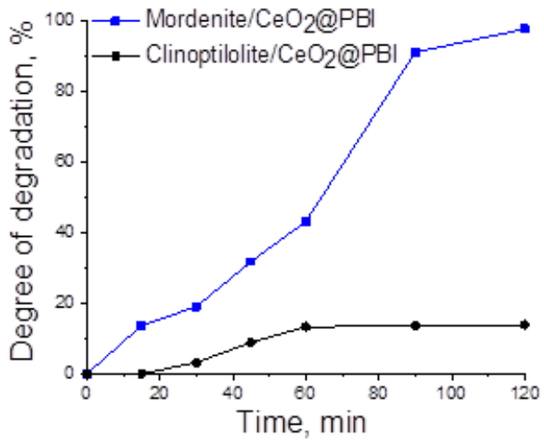
Sample	MgO	Al_2O_3	SiO_2	P_2O_5	K_2O	CaO	TiO_2	MnO_2	Fe_2O_3	Rb_2O	SrO	ZrO_2	ZnO	SO_3	MoO_3	CeO_2
Clinoptilolite/CeO_2@PBI	1.02	7.34	39.4	1.85	9.72	6.44	-	-	0.901	-	0.0255	-	0.110	0.0660	-	33.1
Clinoptilolite	0.771	12.9	73.5	1.17	3.75	6.47	0.186	0.0511	1.20	0.0188	0.0199	0.0096	-	-	0.0030	-
Mordenite	0.766	14.5	69.9	1.25	7.13	4.11	0.308	0.0428	1.80	0.0237	0.134	-	0.0091	0.0305	-	-
Mordenite/CeO_2@PBI	0.599	9.36	42.9	1.6	7.71	3.95	0.0227	-	1.36	-	0.09611	-	0.0159	-	-	32

RESULTS & DISCUSSION





PXRD patterns of the clinoptilolite tuffs, clinoptilolite/CeO_2, clinoptilolite/CeO_2@PBI (■ clinoptilolite, ● high-cristobalite, ▲CeO_2); b) PXRD patterns of the mordenite tuffs, mordenite/CeO_2, mordenite/CeO_2@PBI (◆ mordenite, ▲CeO_2).



The degree of degradation of Reactive Black 5 dye with time of UV illumination using zeolitized tuffs supported green synthesized CeO_2@PBI as photocatalysts.

CONCLUSION

The clinoptilolite or mordenite tuffs supported CeO_2@Polybenzimidazole with incorporated green synthesized cerium dioxide using Veronica officinalis L. extract were successfully prepared.

The mordenite supported green synthesized CeO_2@Polybenzimidazole demonstrate the much higher photocatalytic efficiency for degradation of RB5 dye (degree of degradation – 98% after 120 minutes UV irradiation) compared to that of clinoptilolite supported green synthesized CeO_2@Polybenzimidazole (14%).

ACKNOWLEDGMENTS

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