

Fe₃O₄@chitosan-tannic acid bionanocomposite as a novel nanocatalyst for the synthesis of pyranopyrazoles

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Table S1. Magnetic parameters of Fe₃O₄ and Fe₃O₄@chitosan-tannic acid

Sample	Ms (emu/g)	Mr (emu/g)	Hc (Oe)
Fe ₃ O ₄	56.07	2.12	27.03
Fe ₃ O ₄ @chitosan-tannic acid	36.54	6.1	80.02

Table S2. Optimization of the reaction conditions for the synthesis of pyranopyrazole derivatives

Entry	Solvent	Temperature	Catalyst (mg)	Yield (%)
1	Water	r.t.	-	Trace
2	Ethanol	r.t.	-	Trace
3	Ethanol	r.t.	10	69
4	Ethanol	r.t.	20	94
5	Ethanol	r.t.	30	93
6	Ethanol	Reflux	10	89

7	Ethanol	Reflux	20	90
8	Acetonitrile	r.t.	20	78

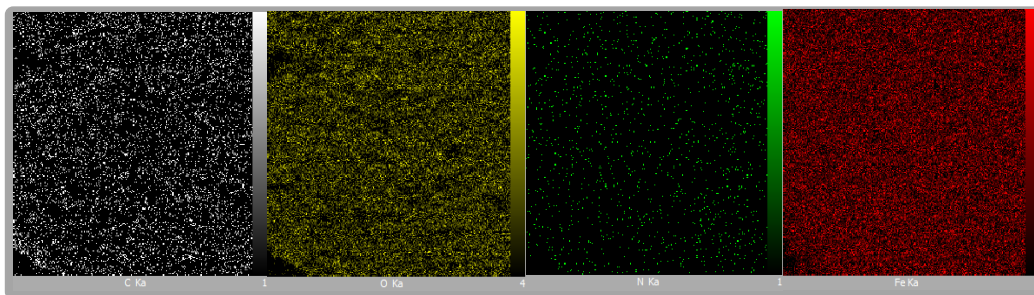


Figure S1. Elemental mapping of Fe₃O₄@chitosan-tannic acid bionanocomposite

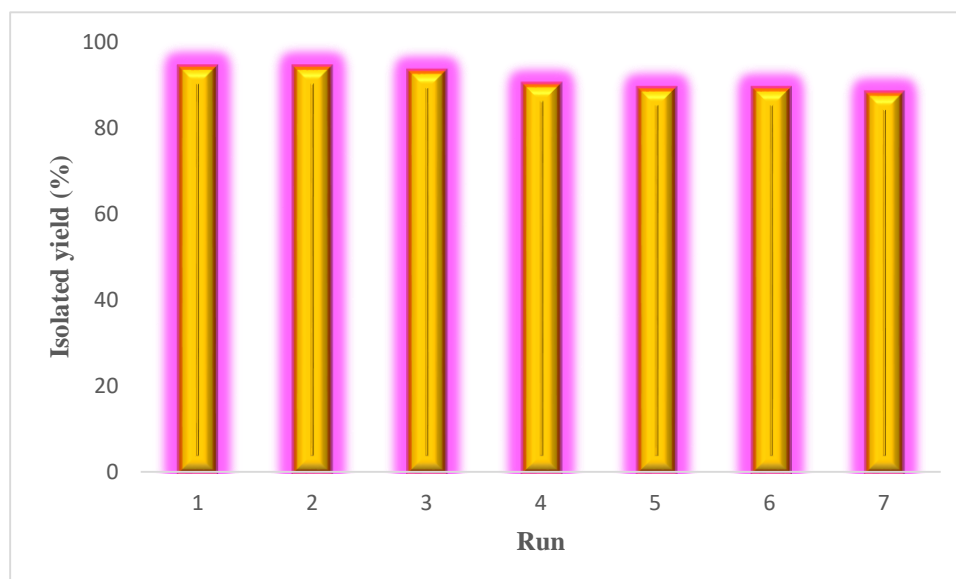


Figure S2. Reusability of the Fe₃O₄@chitosan-tannic acid bionanocomposite

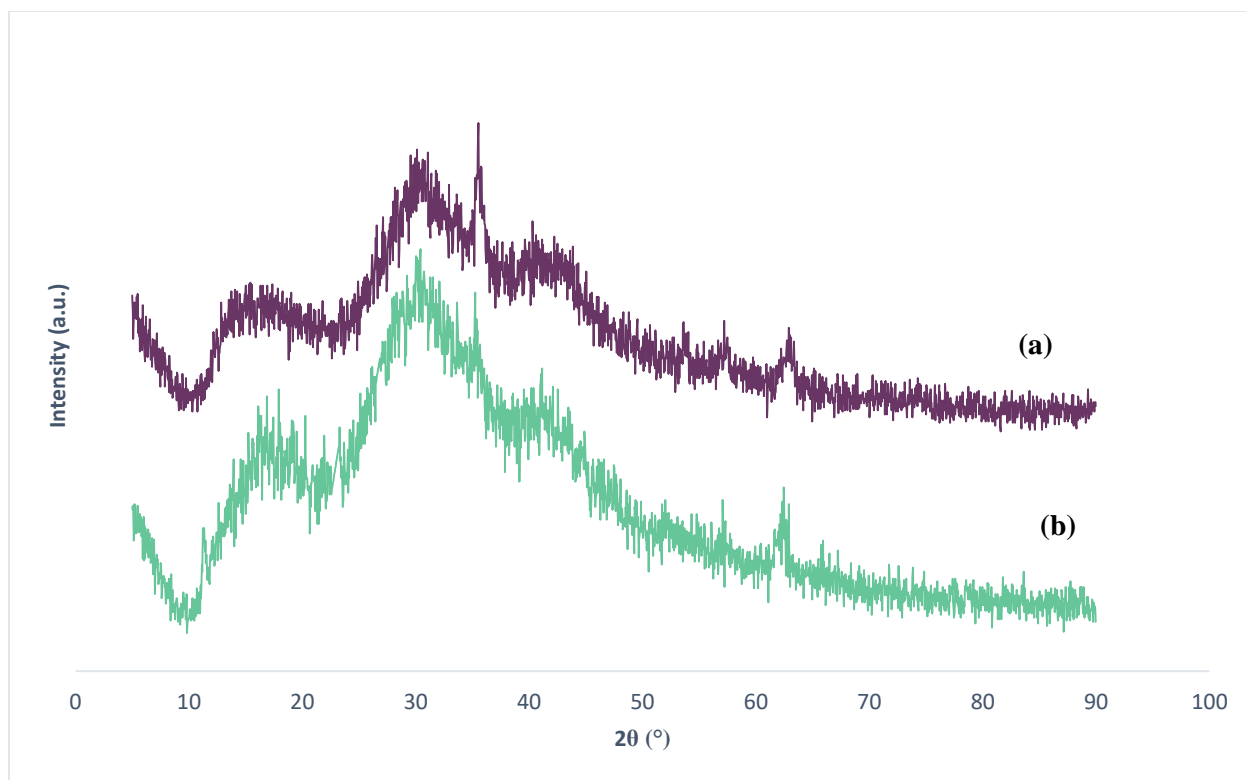


Figure S3. XRD patterns of (a) Fe_3O_4 @chitosan-tannic acid bionanocomposite; and (b) recycled bionanocomposite

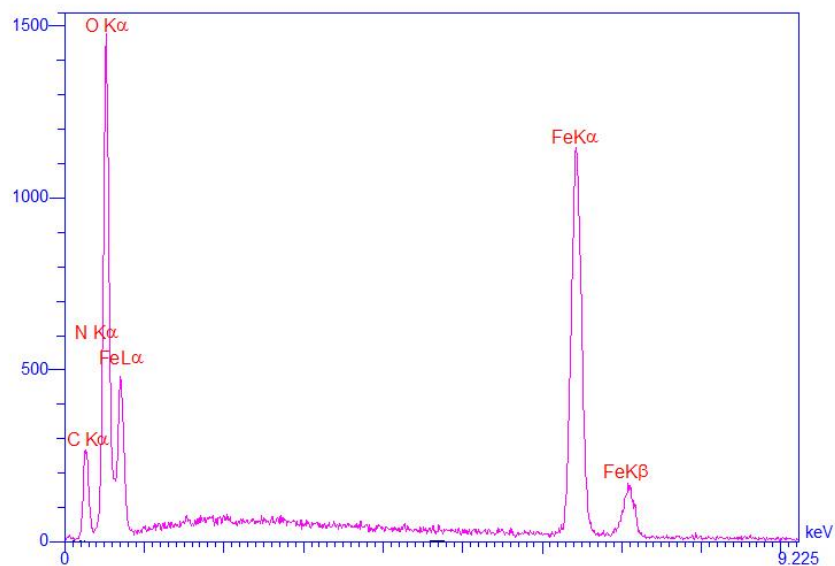


Figure S4. EDX analysis of recycled Fe_3O_4 @chitosan-tannic acid bionanocomposite

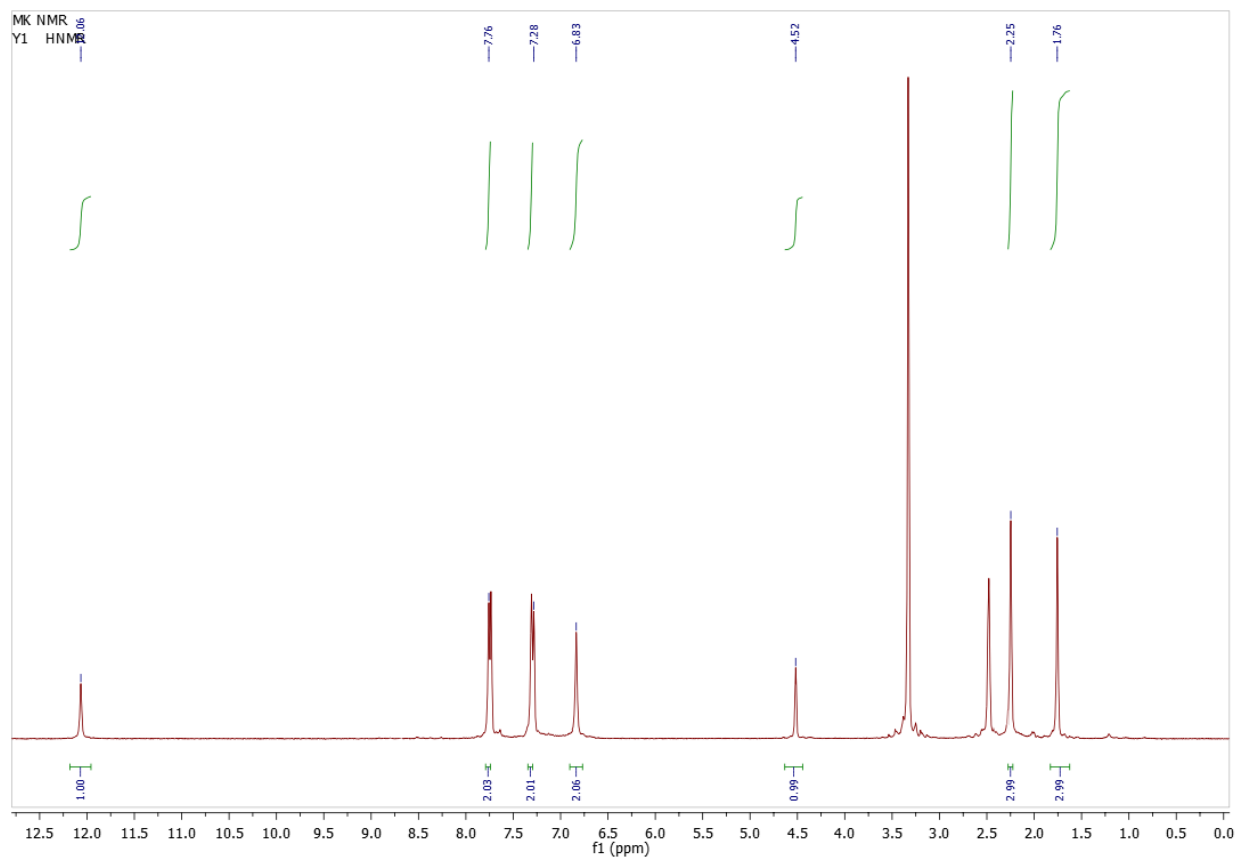


Figure S5. ^1H NMR spectrum of the product **5g**

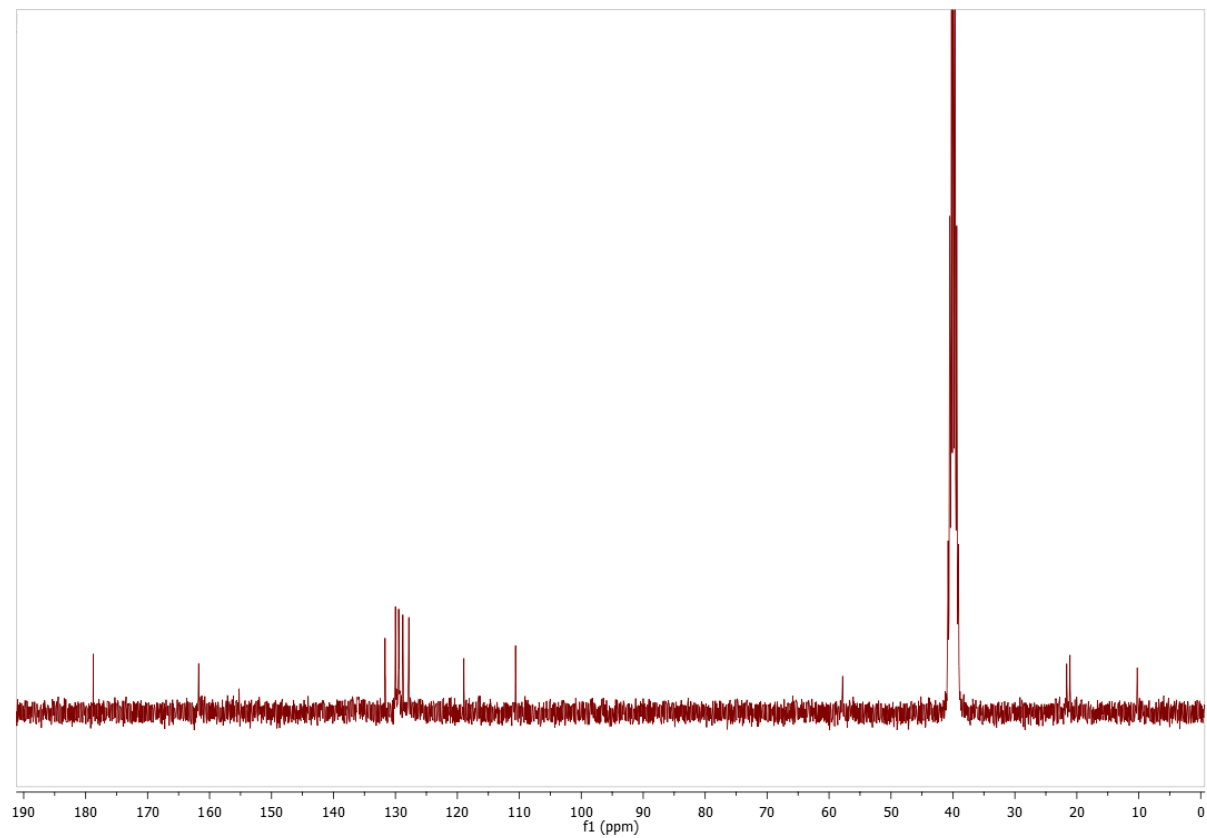


Figure S6. ^{13}C NMR spectrum of the product **5g**

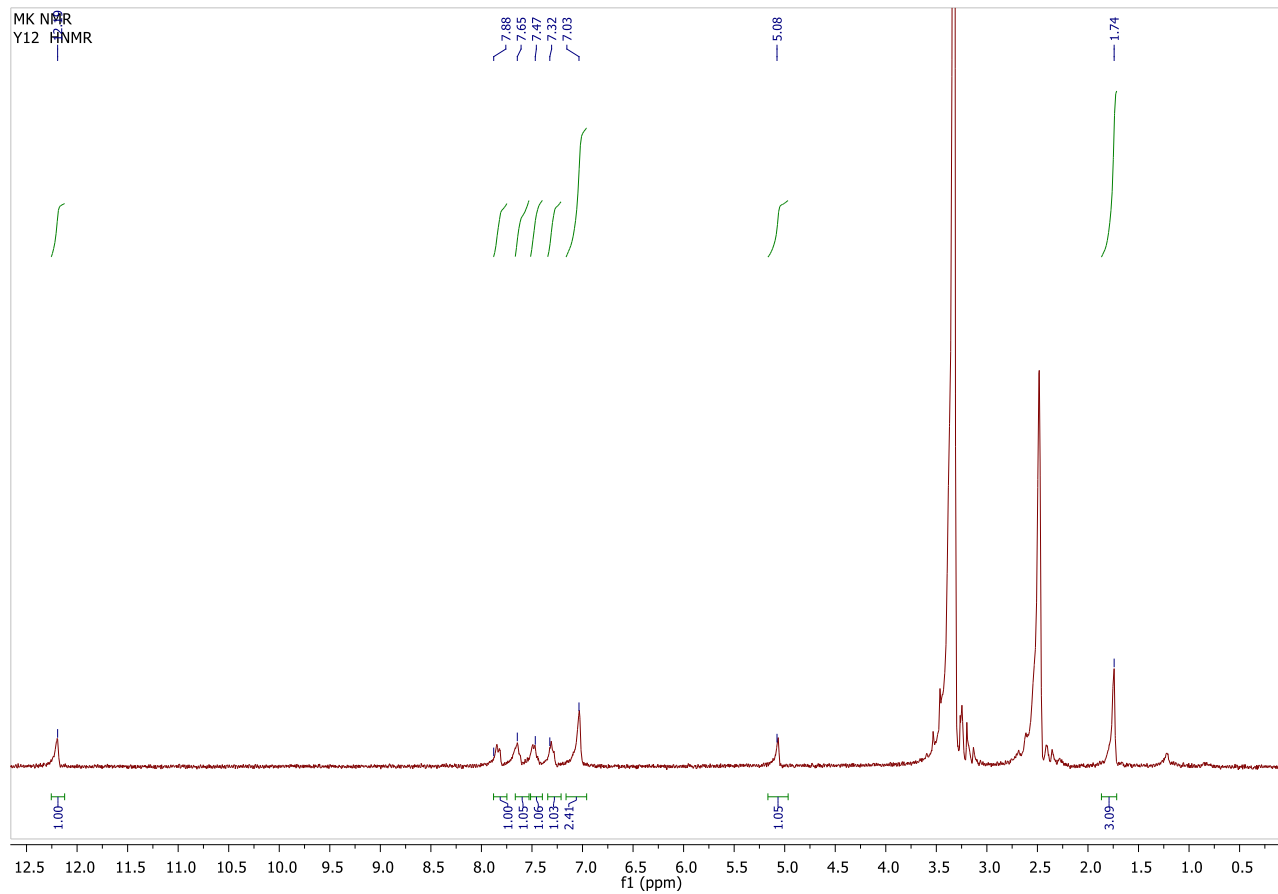


Figure S7. ^1H NMR spectrum of the product **5c**