# Electronic Supporting Information

## Nano ordered polyacrylonitrile-grafted chitosan as a robust bio-based catalyst for efficient synthesis of highly substituted pyrrole derivatives

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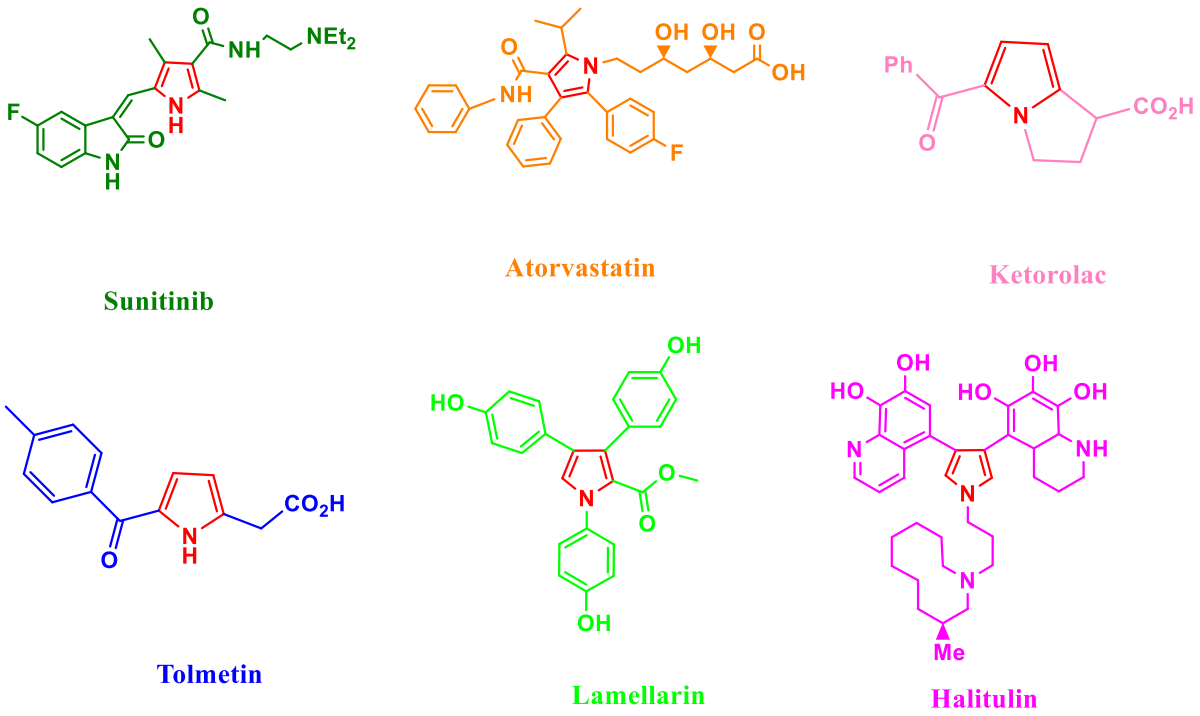



**Fig. S1.** The chemic al structure of selected examples of pharmacologically-active pyrrole derivatives.

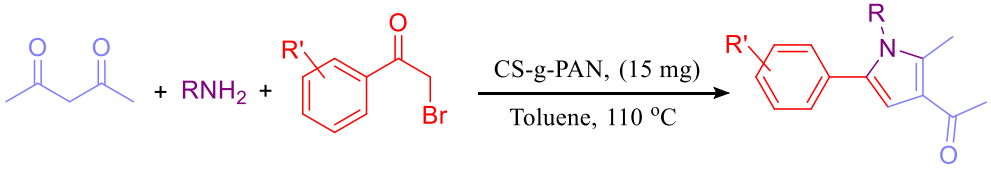



**Fig. S2.** One-pot three-component reaction of acetyl acetone, phenacyl bromide and amine derivatives catalyzed by the CS-g-PAN for synthesis of pyrrole derivatives.

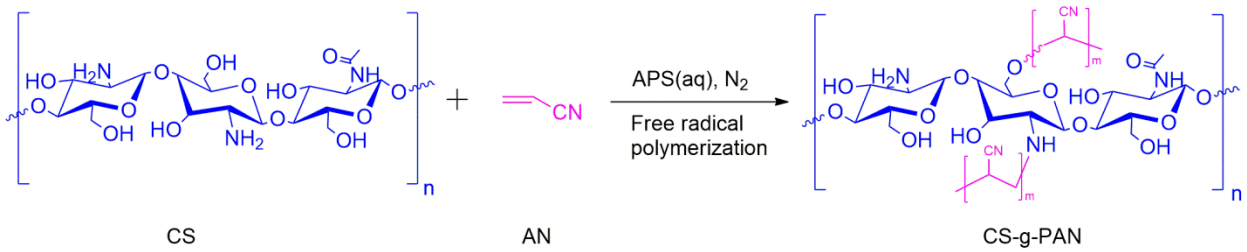



**Fig. S3.** Schematic representation for the preparation of CS-g-PAN nanomaterial (**1**).

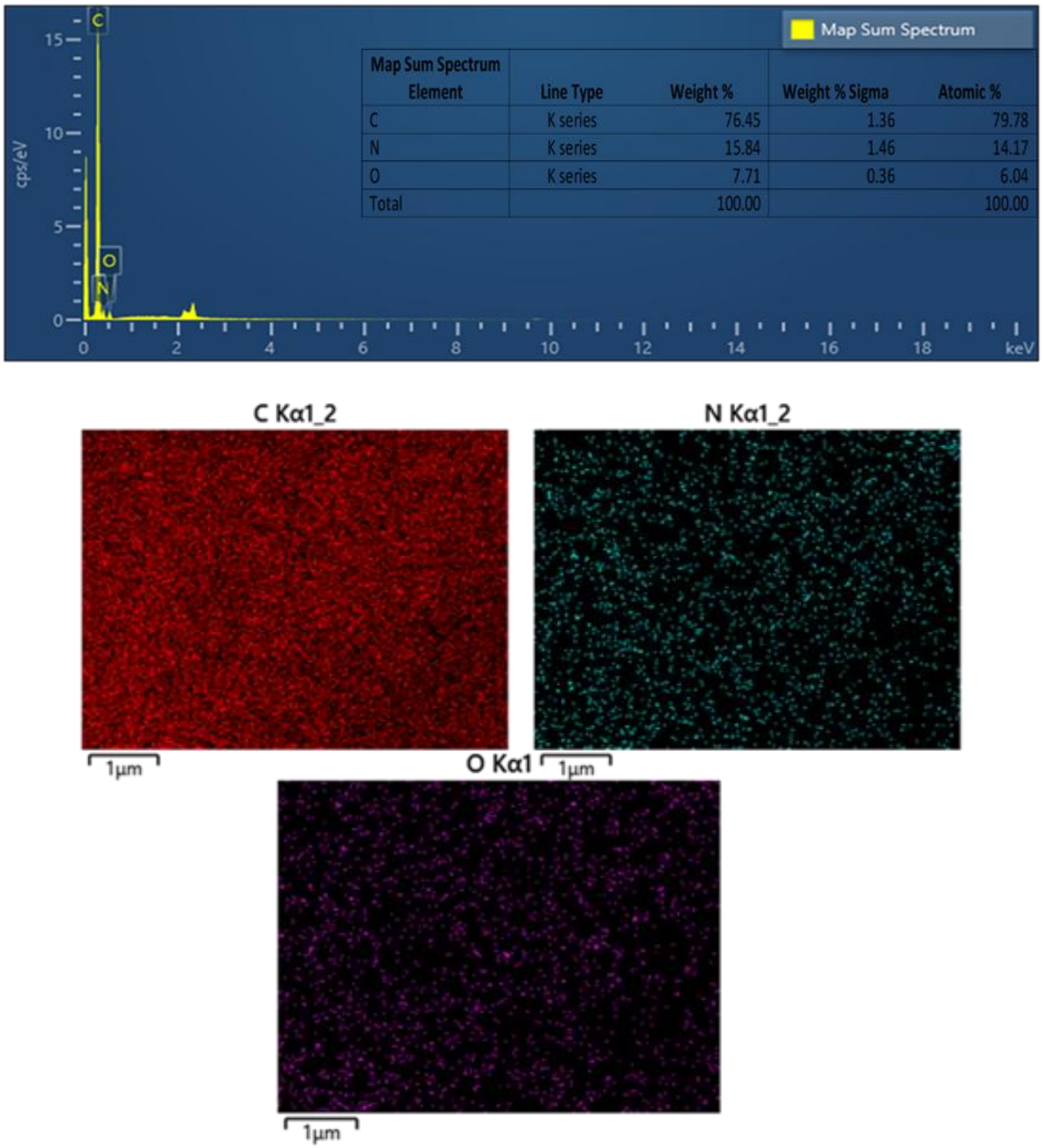



**Fig. S4.** (a) Eenergy-dispersive X-ray spectrum and (b) EDS elemental mapping of CS-g-PAN nanomaterial (1) for the distribution of C, N, and O atoms, respectively.

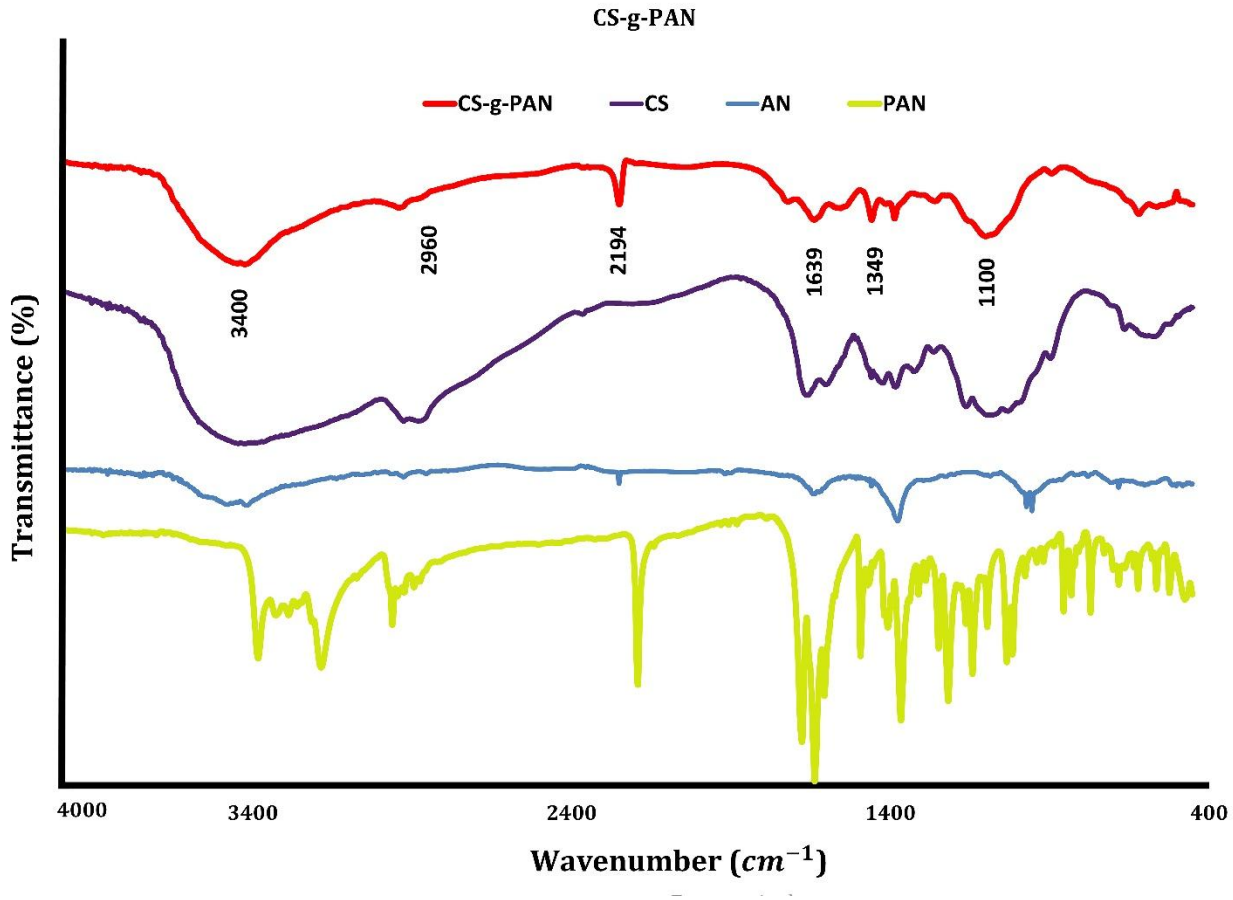
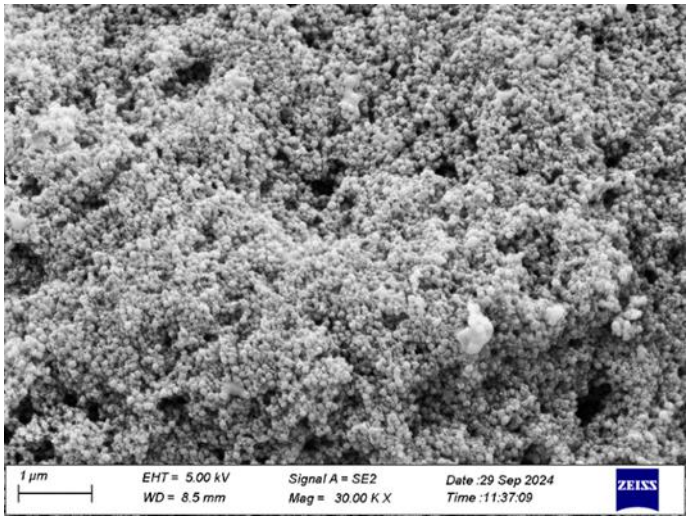



**Fig. S5.** FTIR spectra of the CS-g-PAN (**1**), CS, AN and PAN.



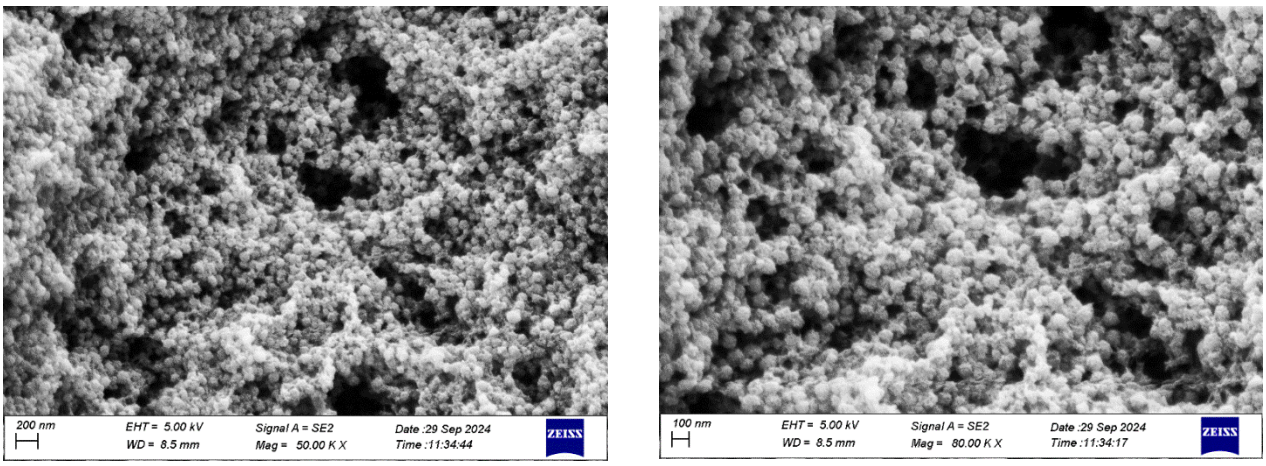



**Fig. S6.** FESEM images of CS-g-PAN nanomaterial (**1**) (scale bars: 1 µm, and 200 and 100 nm).

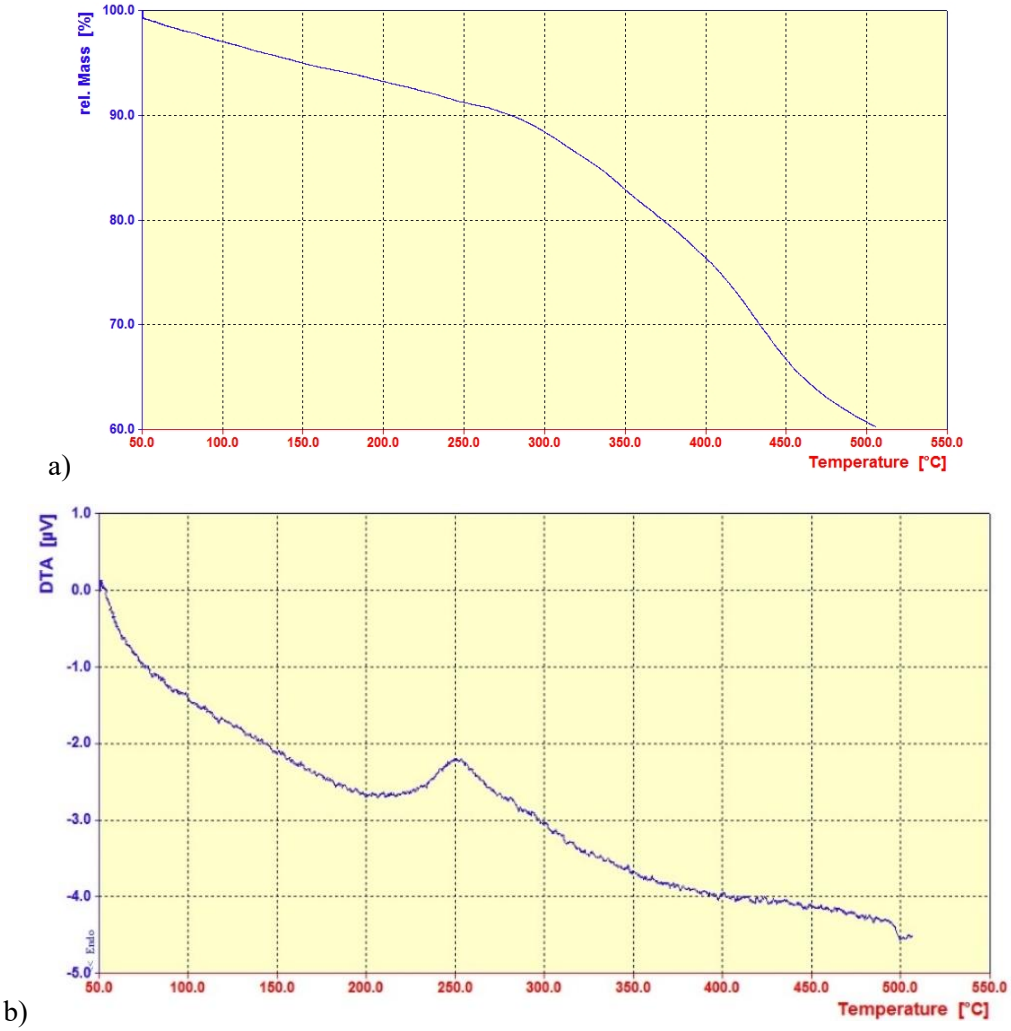



**Fig. S7.** (**a**) TGA and (**b**) DTA curves of the CS-g-PAN nanomaterial (**1**).

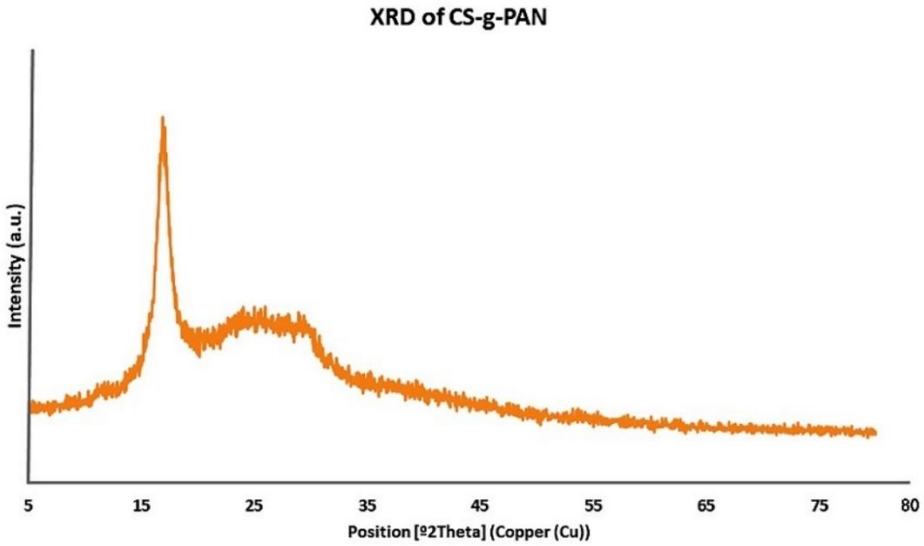



**Fig. S8.** XRD analysis of the CS-g-PAN nanomaterial (**1**).

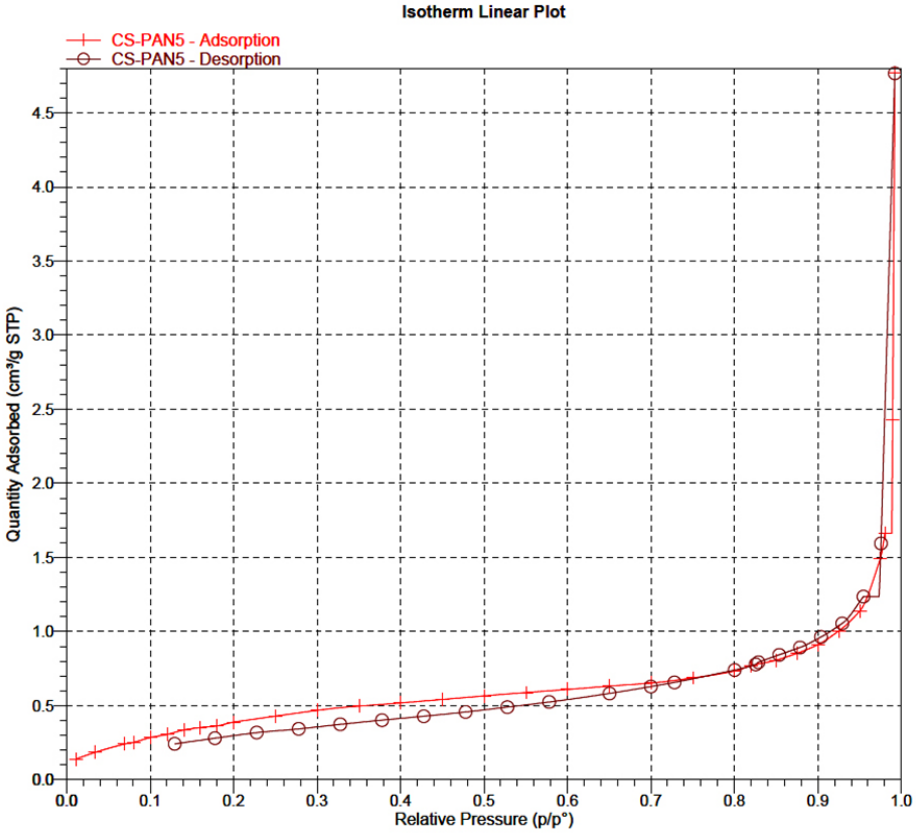



**Fig. S9.** BET analysis of the CS-g-PAN nanomaterial (**1**).

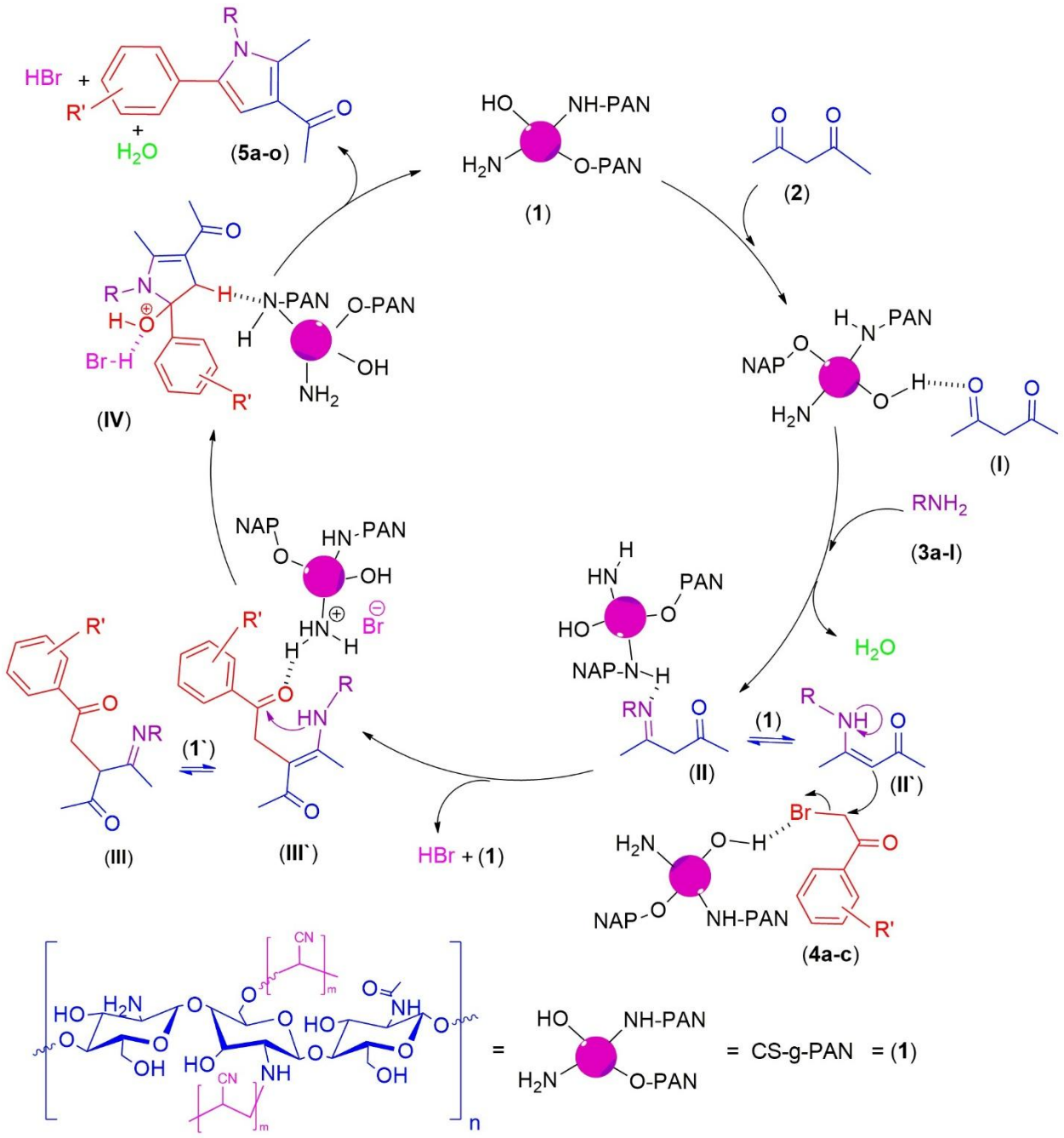



**Fig. S10.** Proposed mechanism for the synthesis of pyrrole derivatives **5a-o** catalyzed by the CS-g-PAN (**1**).

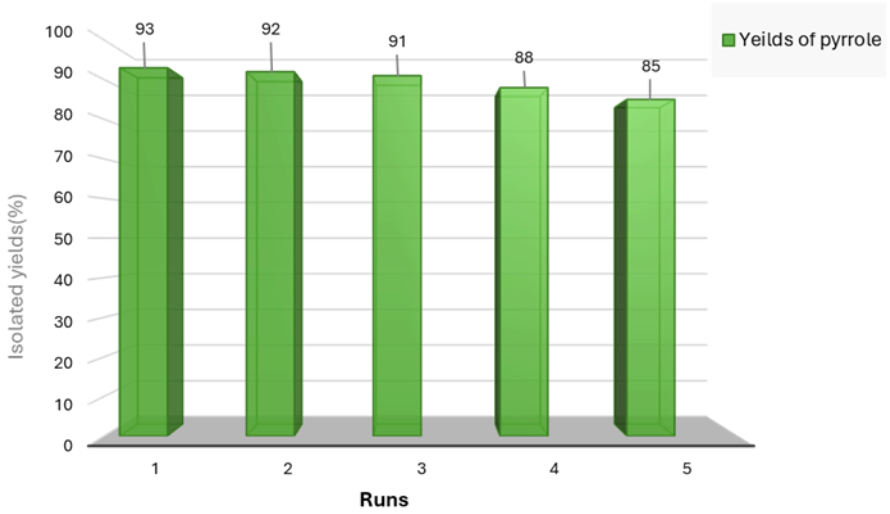



**Fig. S11.** Reusability of the recycled CS-g-PAN catalyst (**1**) for the synthesis of pyrrole derivative **5a**.

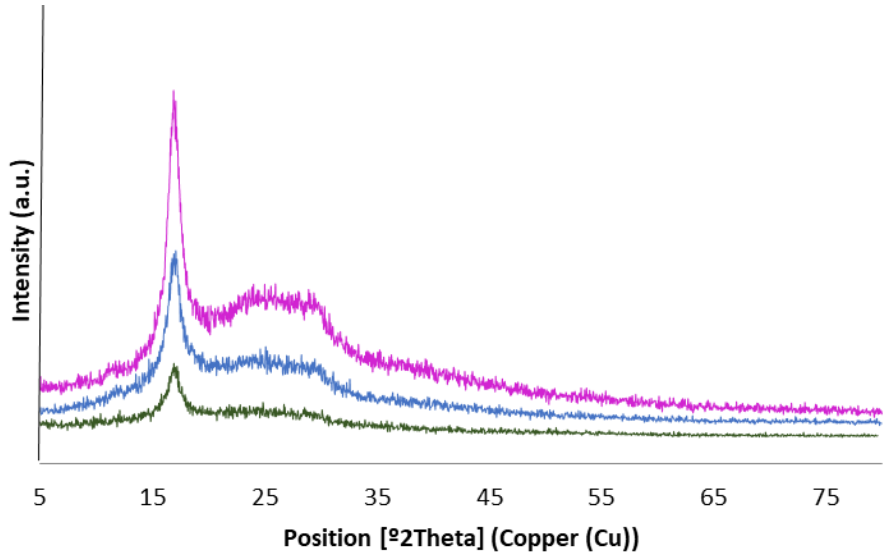
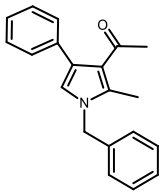
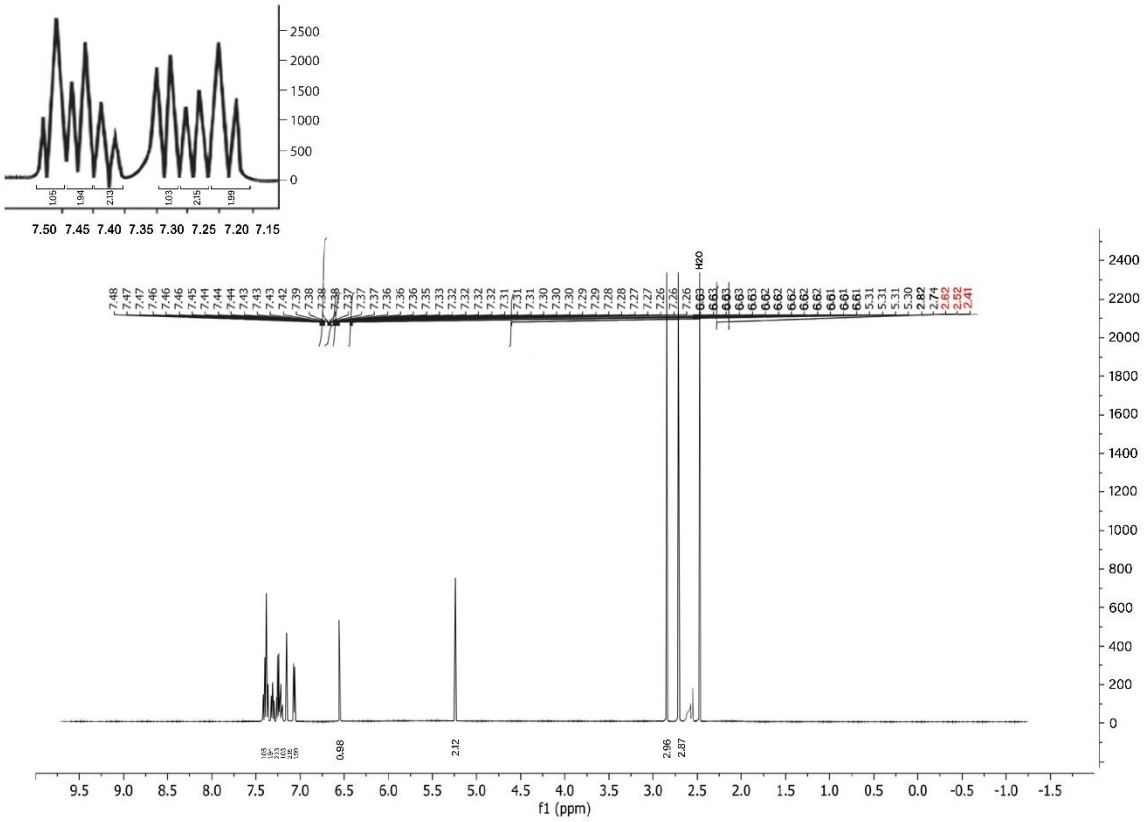



**Fig. S12.** XRD analysis of the recycled CS-g-PAN (**1**) catalyst after first, third and fifth runs (from top to down).

**Selected Spectral Data:**

**1-(1-benzyl-2-methyl-4-phenyl-*1H*-pyrrol-3-yl) ethenone:** Brown solid; M.P = 48 - 50 ℃; $^1$H NMR (DMSO-$d_6$, 400 MHz) δ (ppm): 2.74 (s, 3H, $CH_3$), 2.82 (s, 3H, $CH_3$), 5.31 (s, 2H, $CH_2$), 6.62 (s, 1H, CH), 7.26–7.48 (m, 10H).





**1-(4-(4-chlorophenyl)-2-methyl-1-phenyl-*1*H-pyrrol-3-yl) ethenone:** Light brown solid; M.P = 148 - 149 ℃; $^1$H NMR (DMSO-$d_6$, 400 MHz) δ (ppm): 2.74 (s, 3H, $CH_3$), 2.81 (s, 3H, $CH_3$), 6.75 (s, 1, CH), 7.55-7.70 (m, 9H).