**Physicochemical parameter influences and their optimization on the biosynthesis of MnO2 nanoparticles using *Vernonia amygdalina* leaf extract**

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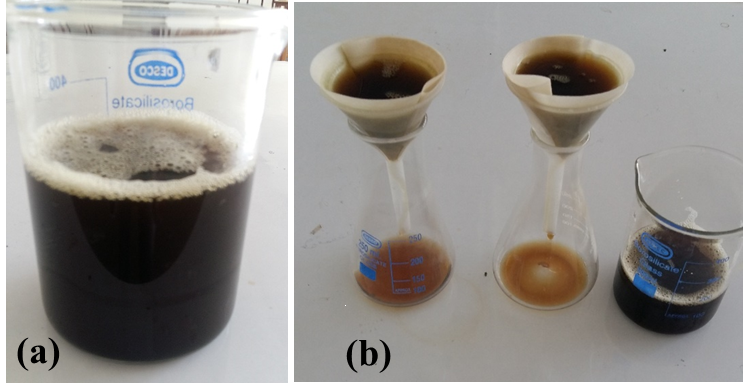
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**Fig. S1** Images of (a) Fresh leaves, (b) Dried, and (c) powdered Vernonia amygdalina plant

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**Fig. S2** (a) Aqueous extracted and (b) filtration of *Vernonia amygdalina* (Photograph pictures).



**Fig. S3** UV-Vis spectrum of biosynthesized MnO2 NPs (R stands for experimental run)



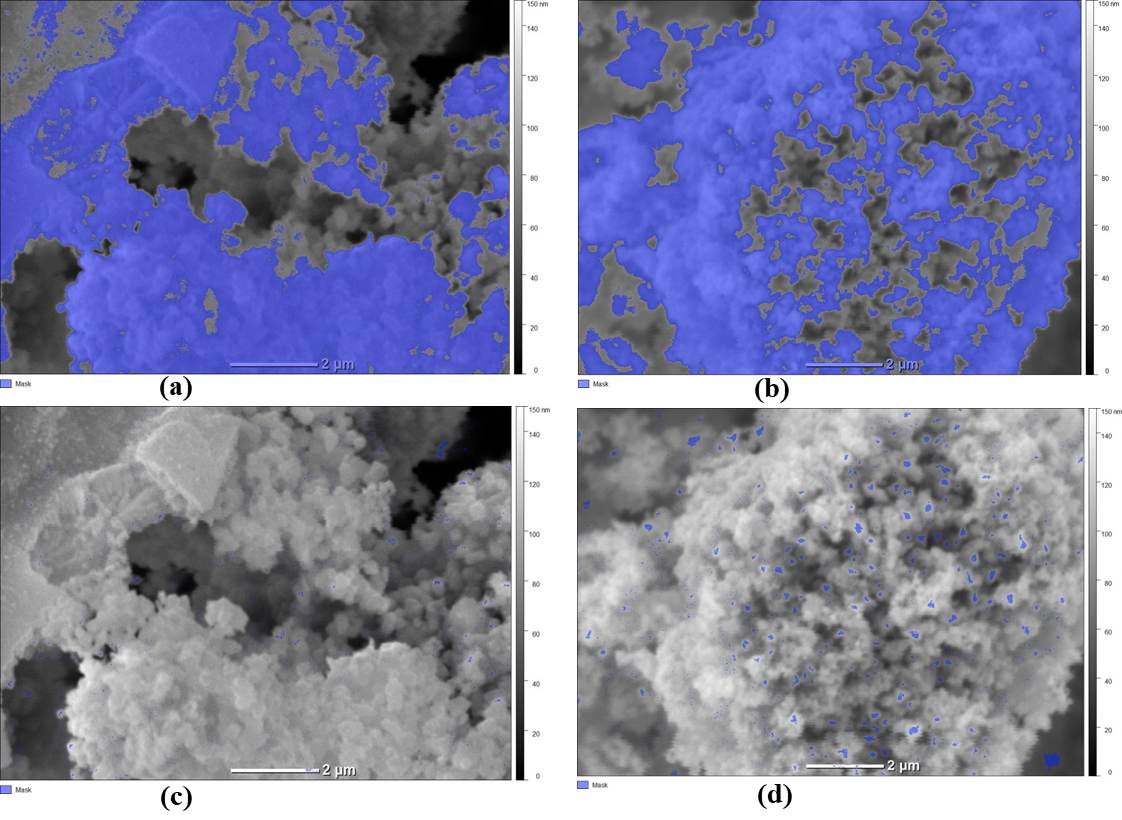
**Fig. S4** Ramps graph of numerical optimized physicochemical conditions.



**Fig.S5** Desirability effect of absorbance on physicochemical parameters dependence



**Fig. S6** UV-vis spectrum of MnO2 NPs in optimum condition (Exp = Experimental at 320 nm)

**Fig. S7** Grain marked results by the threshold method (a) after 2 hour calcination time and (b) after 3 hour calcination time; Watershed method (c) after 2 hour calcination time and (d) after 3 hour calcination time for MnO2 NPs calcined at 450 oC.



**Fig. S8** Inverted height distributions versus position (z-axis) graph (total number of points are 120).