Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information:

Graphene-printed paper electrode for determination of H_2O_2 in municipal wastewater during COVID-19 pandemic

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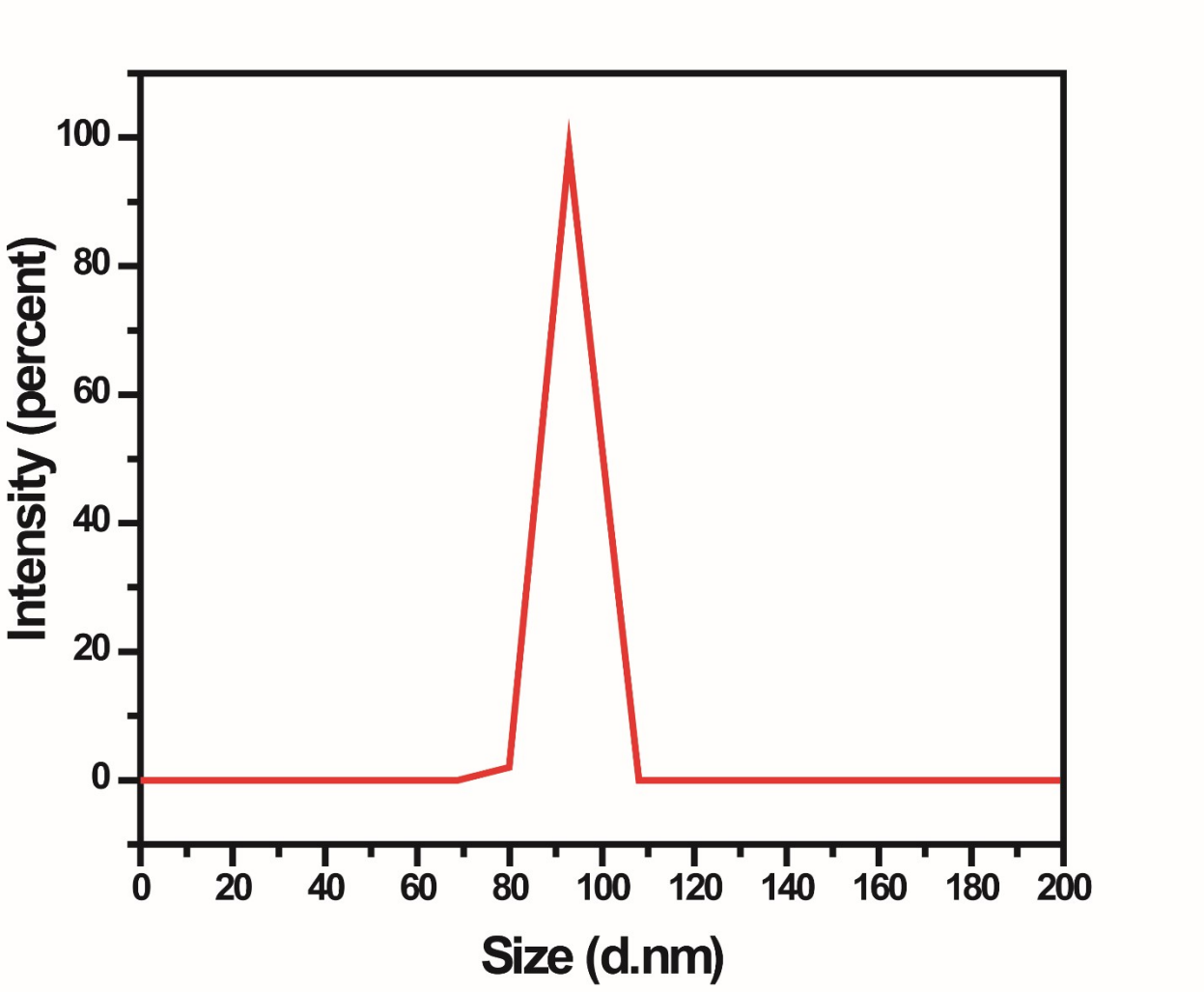

Fig. S1. DLS spectra of graphene ethyl cellulose composite nano ink.

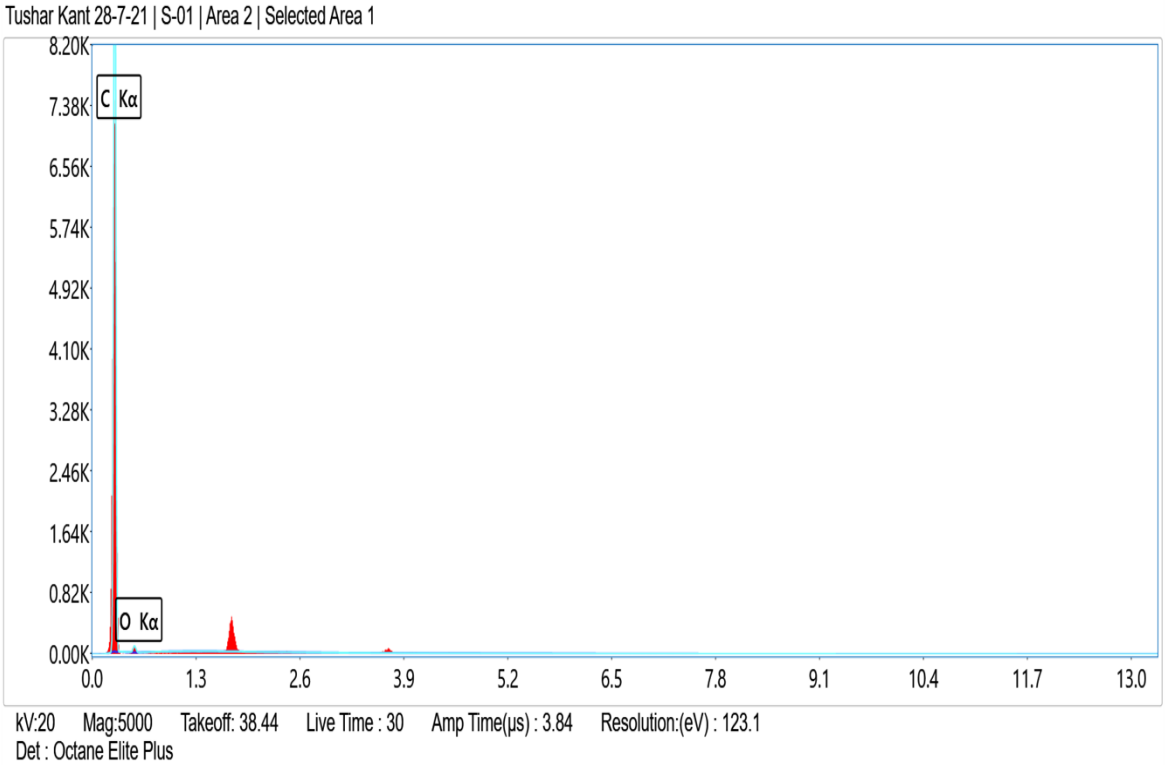

Fig. S2. EDS spectrum of the graphene ethyl cellulose.

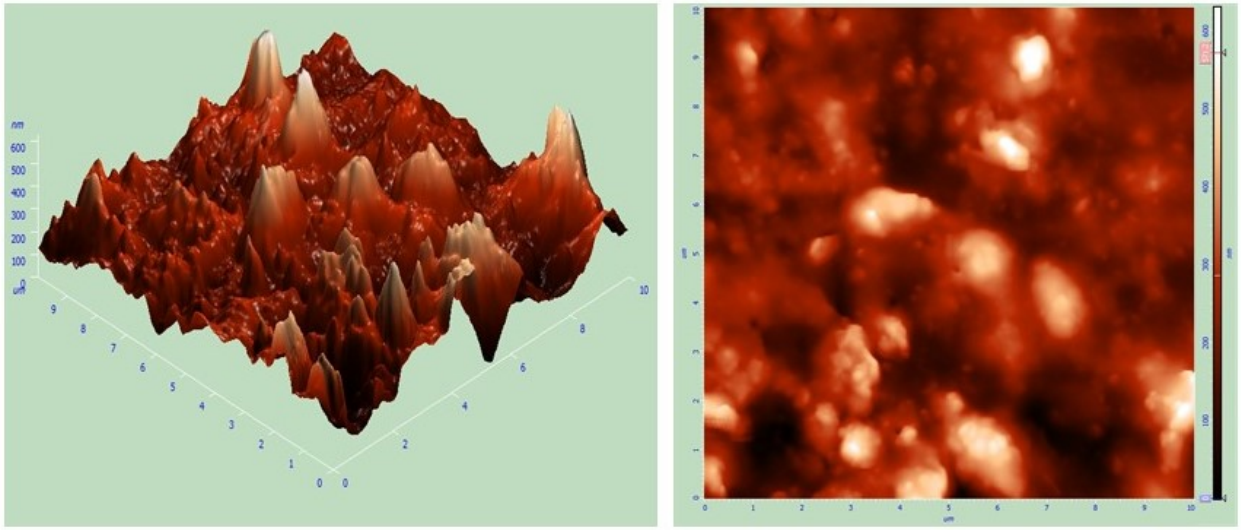

Fig. S3. AFM data of Gr-EC nano ink.

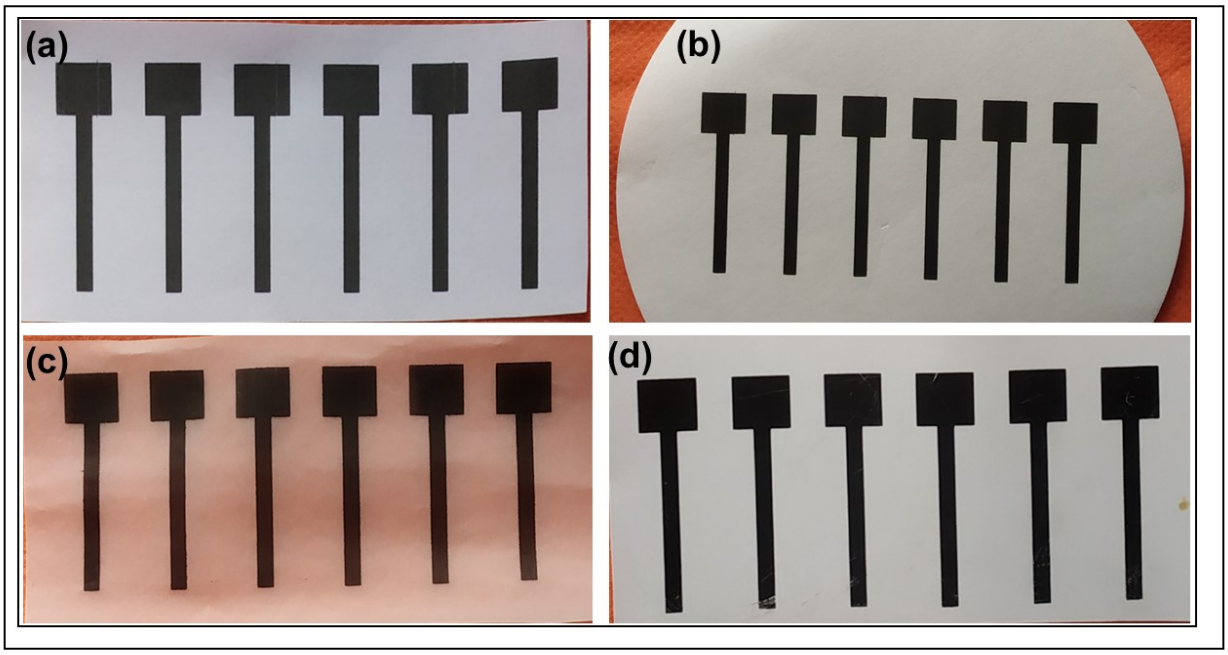

Fig. S4. Deposition of graphene ethyl cellulose nano-ink on paper substrates (a) digital photo paper, (b) Whatman filter paper No. 1, (c) butter paper and (d) bond paper.

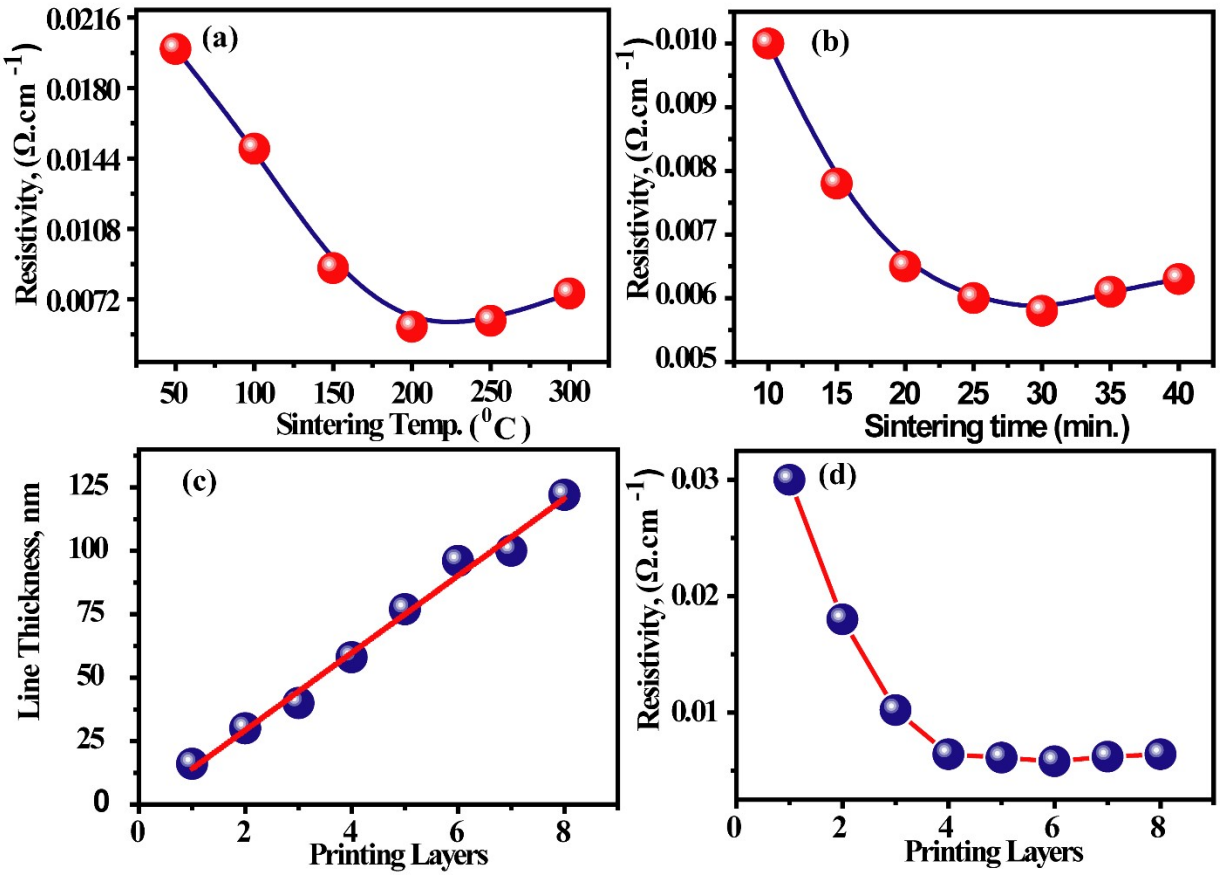

Fig. S5. Electrical characterization of graphene printed layers. (a) Electrical resistivity of paper films plotted against the sintering temperature for a fixed sintering time of 30 min that shows polymer decomposition at 200 °C and increases their resistivity due to graphene oxidation above 300 °C. (b) Dependence of electrical resistivity on the annealing time for a fixed annealing temperature of 200 °C, showing that low resistivity is achieved following annealing for 30 min. (c) Thickness of inkjet-printed graphene lines on photo paper substrate for increasing number of printing layers and (d) Electrical resistivity of printed layer for increasing numbers of printing passes, showing comparatively better result of sixth printing layers.

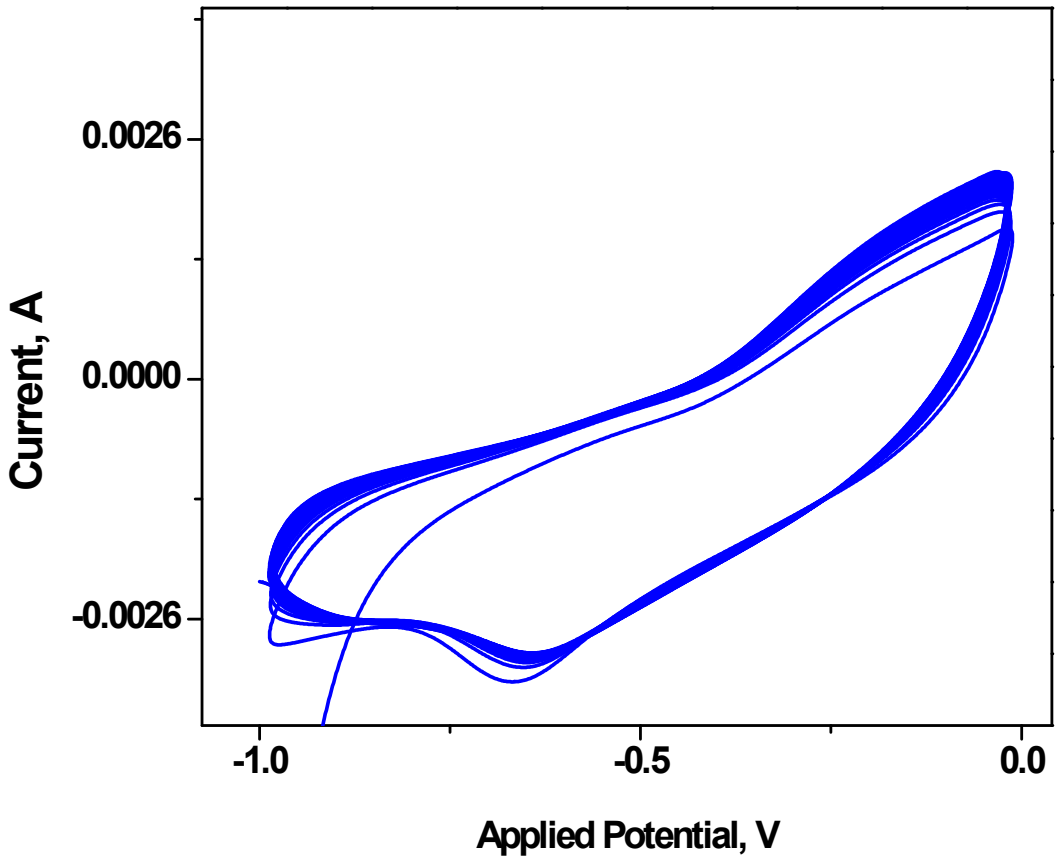

Fig. S6. 30 cycles of CV measurements of 25 mM H_2O_2 when graphene ethyl cellulose was used as a working electrode in the presence of 0.2 M PBS (pH 7.0) and 0.4 M KCl at 0.1 V/s scan rate.

Table S1. Effect of sintering temperature and sintering time on the resistivity of graphene ethyl cellulose /PPE

Sintering Temp. ℃	Resistivity (Ω.cm)	Sintering Time, min	Resistivity (Ω.cm)
50	0.02	10	0.01
100	0.0149	15	0.0078
150	0.0088	20	0.0065
200	0.0058	25	0.006
250	0.0061	30	0.0058
300	0.0075	35	0.0061

Table S2. Effect of printing layers with varying sintering temperature sintering time on resistivity of graphene ethyl cellulose /PPE

Printing Layers	Layer Thickness (nm)	Printing Layers	Resistivity (Ω.cm)
1	16	1	0.03
2	30	2	0.018
3	40	3	0.0102
4	58	4	0.0064
5	77	5	0.0061
6	96	6	0.0058
7	100	7	0.0062
8	101	8	0.0064

Table S3. Determination of RSD, % (precision) of reduction potential and reduction current when Gr-EC/PPE used as a working electrode for 30 cycle scanning with 25 mM H_2O_2.

S. No.	Reduction Potential (V)	Reduction Current (A)
1.	-0.679	-0.0030374
2.	-0.645	-0.003143
3.	-0.647	-0.0030556
4.	-0.649	-0.00307157
5.	-0.651	-0.00305549
6.	-0.653	-0.00304243
7.	-0.655	-0.00303383
8.	-0.657	-0.00301517
9.	-0.659	-0.00300192
10.	-0.661	-0.00298906
11.	-0.663	-0.00297218
12.	-0.665	-0.00295101
13.	-0.667	-0.00295831
14.	-0.634	-0.00299454
15.	-0.636	-0.00300101
16.	-0.638	-0.00299514
17.	-0.664	-0.00299372
18.	-0.642	-0.00299253
19.	-0.644	-0.00299004
20.	-0.646	-0.00299123

21.	-0.648	-0.00299317
22.	-0.650	-0.00298865
23.	-0.652	-0.00298662
24.	-0.654	-0.00299826
25.	-0.656	-0.00300293
26.	-0.658	-0.003002
27.	-0.661	-0.00300002
28.	-0.662	-0.00299334
29.	-0.628	-0.00300114
30.	-0.666	-0.00298498
SD	0.010973	3.67228E- 05
Mean	-0.653	-0.00300788
RSD %	± 1.68	± 1.22

Table S4. Determination of stability of Gr-EC/PPE when Gr-EC/PPE used as a working electrode for 30 days with 25 mM H_2O_2.

Number of Days	Reduction Potential (V)	Reduction Current (A)
1.	-0.628	-0.00300114
2.	-0.634	-0.00299454
3.	-0.636	-0.00300101
4.	-0.638	-0.00299514
5.	-0.642	-0.00299253
6.	-0.644	-0.00299004
7.	-0.645	-0.003143
8.	-0.646	-0.00299123
9.	-0.647	-0.0030556
10.	-0.648	-0.00299317
11.	-0.649	-0.00307157
12.	-0.65	-0.00298865
13.	-0.651	-0.00305549
14.	-0.652	-0.00298662
15.	-0.653	-0.00304243
16.	-0.654	-0.00299826
17.	-0.655	-0.00303383
18.	-0.656	-0.00300293
19.	-0.657	-0.00301517
20.	-0.658	-0.003002
21.	-0.659	-0.00300192
22.	-0.661	-0.00298906
23.	-0.661	-0.00300002
24.	-0.662	-0.00299334
25.	-0.663	-0.00297218
26.	-0.664	-0.00299372
27.	-0.665	-0.00295101

28.	-0.666	-0.00298498
29.	-0.667	-0.00295831
30.	-0.679	-0.0030374

Table S5. Calculation of recovery % of hydrogen peroxide in wastewater sample when graphene ethyl cellulose /PPE used as working electrode in optimized condition.

Amount of H_2O_2 added (μM)	Amount of H_2O_2 found (μM)	Recovery %
20	19.5	97.5
50	47.5	95.0
100	94.8	94.8