Supporting Information

Chemiresistive sensor for breath frequency and ammonia concentration in exhaled gas over PVA/ PANI/CC composite film

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Figure S1. Optical photographs of (a) solution of PVA-PANI-CC composites, (b) fabricated PVA-PANI-CC/ITO coated glass film, (c) fabrication of film into the mask (d) complete breath monitoring setup (e) humidity sensor setup.

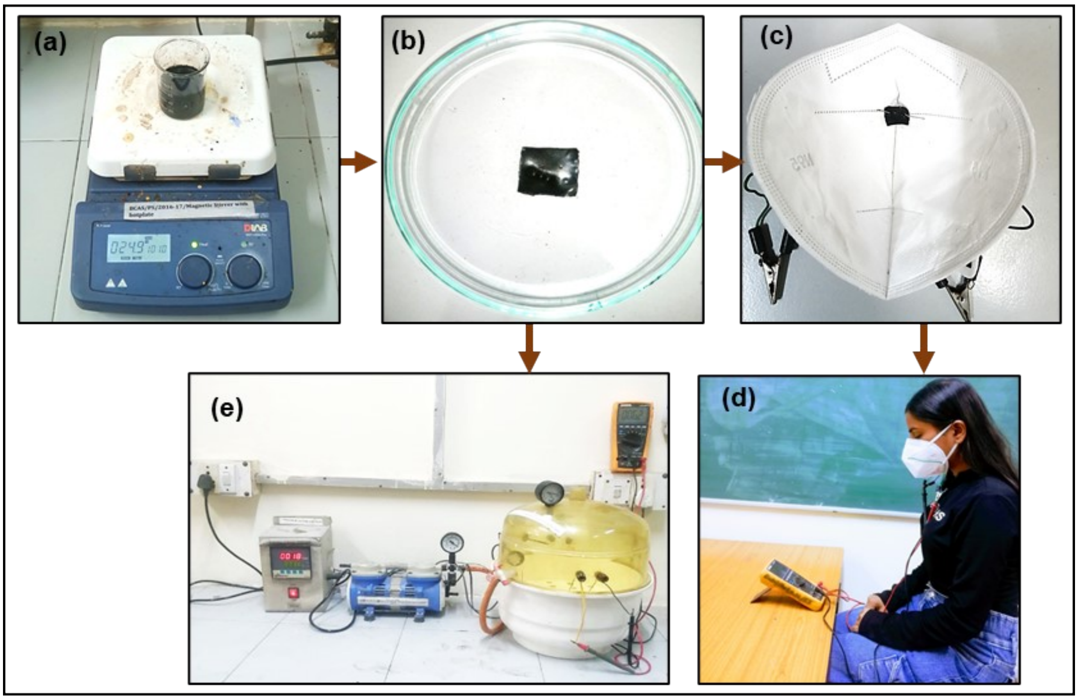


Figure S2. The biodegradability measurement of **(a)** prepared sample for the burial test **(b)** buried sample in soil **(c)** degraded sample over time.

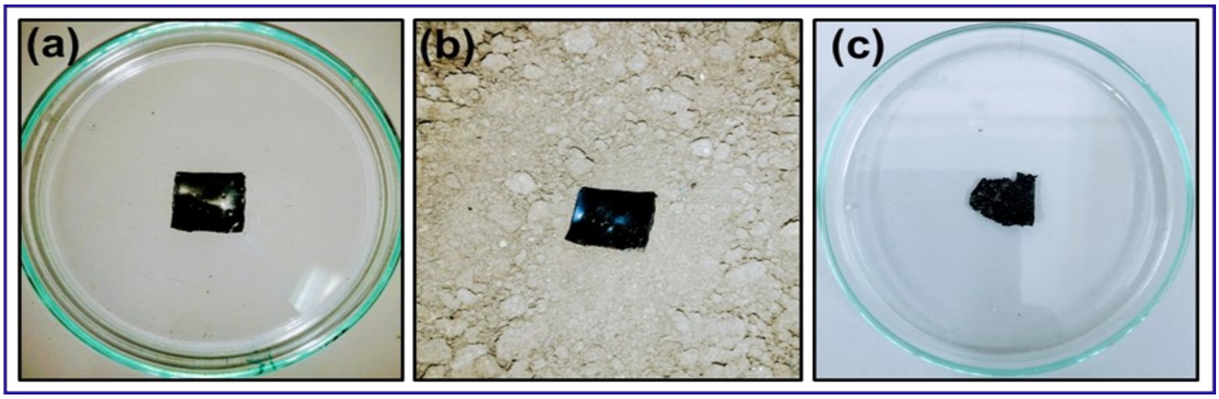
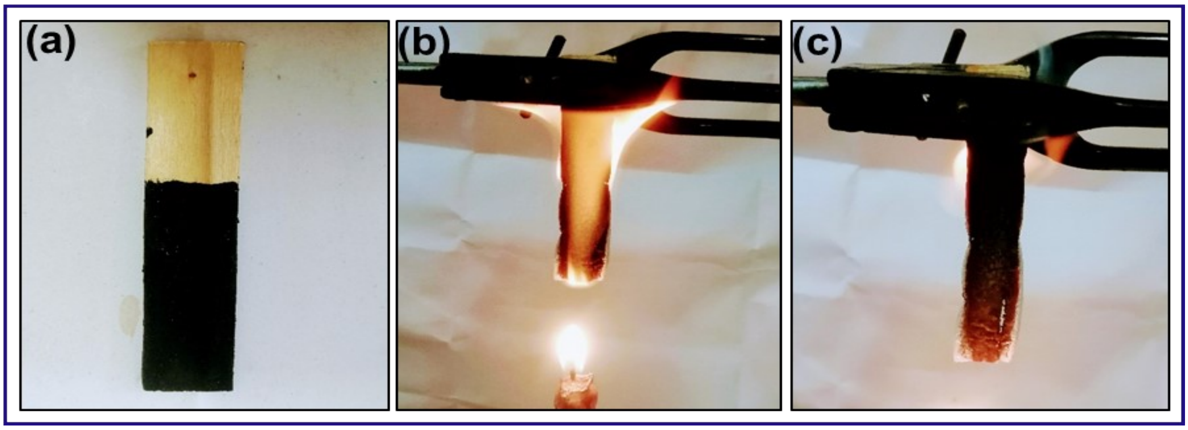


Figure S3. The flame-retardant measurements of **(a)** PVA-PANI-CC composite coated wooden specimen **(b)** burning tests of developed PVA-PANI-CC composites **(c)** residue after burning test.



The results obtained from Fig. S3 are revealing significant improvement in flame retardancy of PVA from V0 to V2 after addition of china-clay and PANI. It is due to the evolution of synergetic packed structure along with better water adsorption and char formation nature. The reduced burning nature further lowers the burning rate by 55 % of its original values[1].

Figure S4: (a) Change in resistance of PVA-PANI-CC against relative humidity, (b) Change in resistance of PVA-PANI-CC with time at 80% RH.

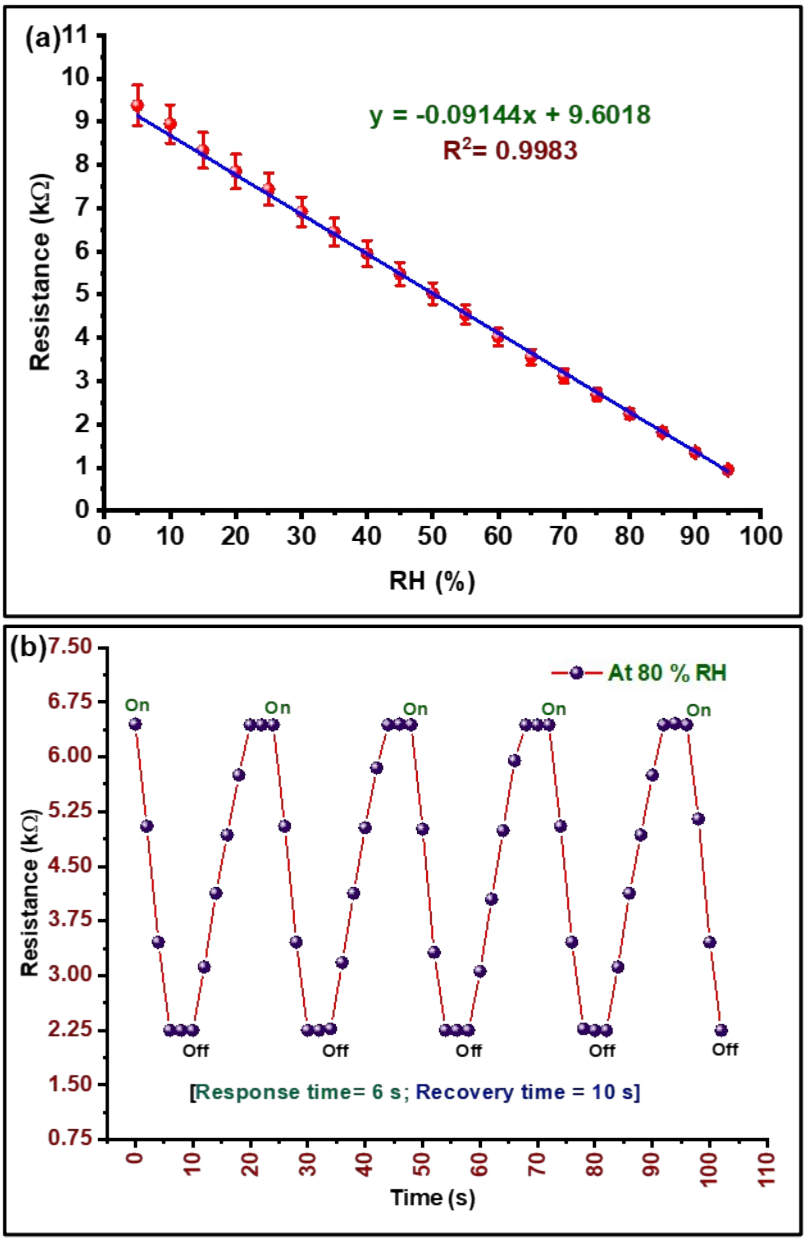


Figure S5. Variation in the sensing response of the PANI-PVA-CC based sensor with interval of 10 Days (Stability curve).

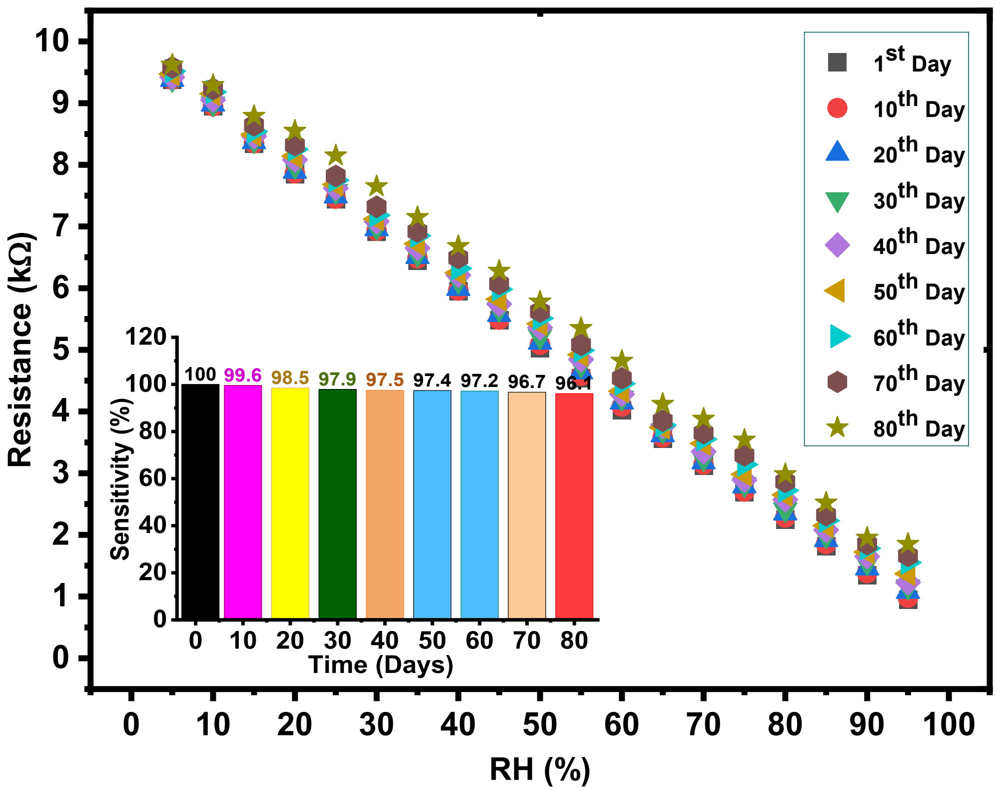


Table S1: The FTIR peaks along with their respective functional groups.

S. N.	Functional groups	PVA (cm^{-1})	PANI (cm^{-1})	PVA-PANI-China clay (cm^{-1})
1	N-H/OH Stretching	3341	3416	3412
2	C-H stretching	2902	2854, 2899	2876, 2960
3	C=O Stretching	-	-	1716
4	C – C Stretching	1634	1602	1607
5	Quinonoid (Q) ring stretching	-	1505	1518
6	Benzenoid (B) ring stretching	-	1452	1458
7	ν(C–N) of secondary aromatic amine	-	1302	1297
8	ν(C–N) in BBB unit	-	-	1235
9	N=Q=N/δ(C–H) vibrations	-	1161	1174
10	B–NH–B/δ(C–H) vibrations	-	1090 (*l*)	1109 (s)
11	C-O Stretching	1042	-	1030
12	C-H Bending	-	743	745

Table S2: XRD derived parameters

S. No.	Samples	XRD Parameters		
		Angle (2θ)	Plane (hkl)	*d*-value (Å)
1.	PVA	19.7°	(101)	4.53
		22.6°	(200)	3.91
		40.5°	(111)	2.21
2.	PANI	20.2°	(100)	4.31
		25.5°	(110)	3.42
3.	PVA-PANI-CC	10.1°	(011)	9.78
		18.5°	(101)	4.77
		20.5°	(100)	4.31
		25.5°	(110)	3.42
		35.9°	(211)	2.38
		38.5°	(220)	2.21
		55.2°	(301)	1.88

Table S3: TG curve derived parameters

S. No.	Samples	TG Analysis		
		Steps	Temperature range (°C)	Weight loss
1.	PVA	1	25 – 100	~10 %
		2	100 – 310	~ 5 %
		3	310 – 400	~75 %
2.	PANI	1	25 – 200	~10 %
		2	200 – 350	~35 %
3.	PVA-PANI-CC	1	25 – 100	~10 %
		2	100 – 300	~ 10 %
		3	310 – 500	~10%

Table S4. Flame-retardant behaviour of constituent and PVA-PANI-CC.

S. N.	Sample	Burning time (s)	Ignition time (s)	Ash contents (%)	Observation

1.	PVA Coated strip **(S1)**	50	20	18.51	Burn with high flame and Bubbles seen while burning.
2.	PVA-PANI Coted strip **(S2)**	75	30	30.78	Slow burning flame with dripping
3.	PVA-PANI-china-clay Coted strip (**S3)**	90	55	36.10	Slow burning flame with dripping

References

1. A. Kumar, S. Kumar and B. P. Tripathi, Polydopamine primed phosphorylated sepiolite-polypropylene nanocomposite with enhanced thermal, rheological, and flame retardant properties, *Polym. Degrad. Stab.*, 2022, **202**, 110005.