

Supporting Information

Fully biocompatible and biodegradable triboelectric nanogenerator based on PVA/Chitosan fibers and PLA fibers with enhanced output performance

Vida Sabzevari^a, Mohammad Mahdi Abolhasani^{a,*}, Sara Azimi^{a,b}

^a Chemical Engineering Department, University of Kashan, 8731753153, Kashan, Iran.

^b Faculty of Petroleum and Chemical Engineering, University of Hormozgan, 7916193145, Bandar Abbas, Iran.

*Corresponding Author

*E-mail: abolhasani@kashanu.ac.ir

Note S1:

We have employed the well-established series capacitor model for TENGs to calculate surface charge density (σ). The V_{OC} of a TENG with two dielectric layers in series is [1]:

$$V_{OC} = \frac{\sigma d_1}{\epsilon_0 \epsilon_{r1}} + \frac{\sigma d_2}{\epsilon_0 \epsilon_{r2}} \quad (S1)$$

where d and ϵ_r are the thickness and relative permittivity of each layer. Solving for σ yields:

$$\sigma = \frac{V_{OC}}{\frac{\sigma d_1}{\epsilon_0 \epsilon_{r1}} + \frac{\sigma d_2}{\epsilon_0 \epsilon_{r2}}} \quad (S2)$$

For TENG based on PVA/Chitosan fiber and PLA fiber, the effective permittivity of PVA/Chitosan layer (ϵ_{r1}) has been calculated using the linear mixing rule based on volume fractions. The volume fraction of PVA (ϕ_{PVA}) has been derived from the known mass fraction ($W_{PVA}=65\%$) and the material densities ($\rho_{PVA}=1.19 \text{ g/cm}^3$, $\rho_{Chitosan}=1.75 \text{ g/cm}^3$):

$$\phi_{PVA} = \frac{\frac{W_{PVA}}{\rho_{PVA}}}{\frac{W_{PVA}}{\rho_{PVA}} + \frac{W_{Chitosan}}{\rho_{Chitosan}}} \quad (S3)$$

Then, the effective permittivity of PVA/Chitosan layer (ϵ_{r1}) has been calculated as:

$$\epsilon_{r1} = \phi_{PVA} \times \epsilon_{PVA} + \phi_{Chitosan} \times \epsilon_{Chitosan} \quad (S4)$$

Using established literature values $\epsilon_{PVA}=6.0$, $\epsilon_{Chitosan}=10.0$, and $\epsilon_{PLA}=3$ [2-4] with layer thicknesses of $50 \text{ }\mu\text{m}$ for both samples, the calculation gives $\epsilon_{r1} \approx 7.1$. Applying Equation (S1) with the

measured $V_{OC}=23.34$ V for PVA/Chitosan fiber-based TENG, the calculated surface charge density is obtained as $9.10 \mu\text{C}/\text{m}^2$. To isolate the effect of the blend, we have performed the same calculation for the TENG based on pure PVA fiber. With the generated V_{OC} of 6.51 V. the calculation yields surface charge density of $2.54 \mu\text{C}/\text{m}^2$.

Table S1. Mass loss of the assembled bilayer sample during biodegradation in PBS buffer over time.

Immersion Time (Days)	Average Mass Loss of Sample (%)
10	9
20	42
40	75
60	96

References

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