

Supporting Information

3D Printed Double Roller-Based Triboelectric Nanogenerator for Blue Energy Harvesting

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1. Measurement condition for the basic electrical outputs

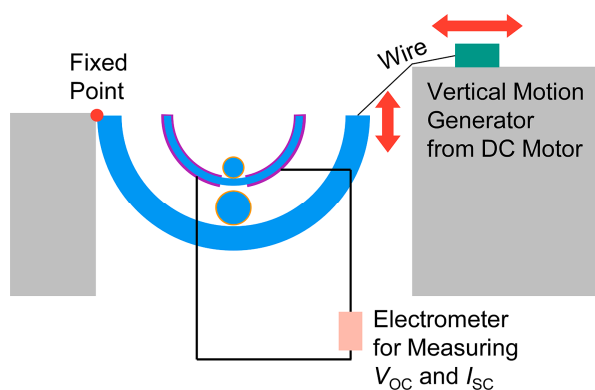


Figure S1. Schematic image for representing the measurement condition of the electrical output.

2. Water wave conditions and movement of the two rollers

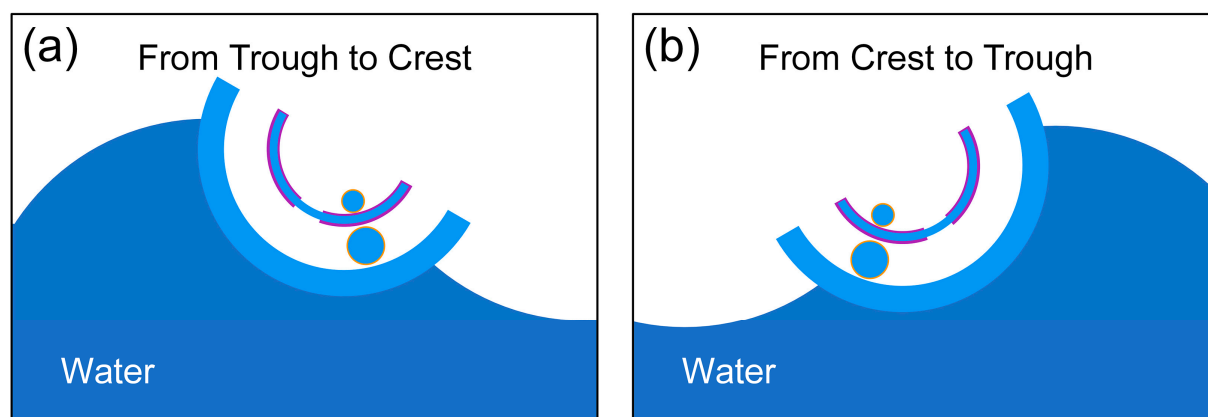


Figure S2. Illustrations for displaying the two water wave conditions of (a) from trough to crest and (b) from crest to trough, showing the location of the double rollers.

3. Water floating test for checking hydrophilicity of acetone-treated ABS

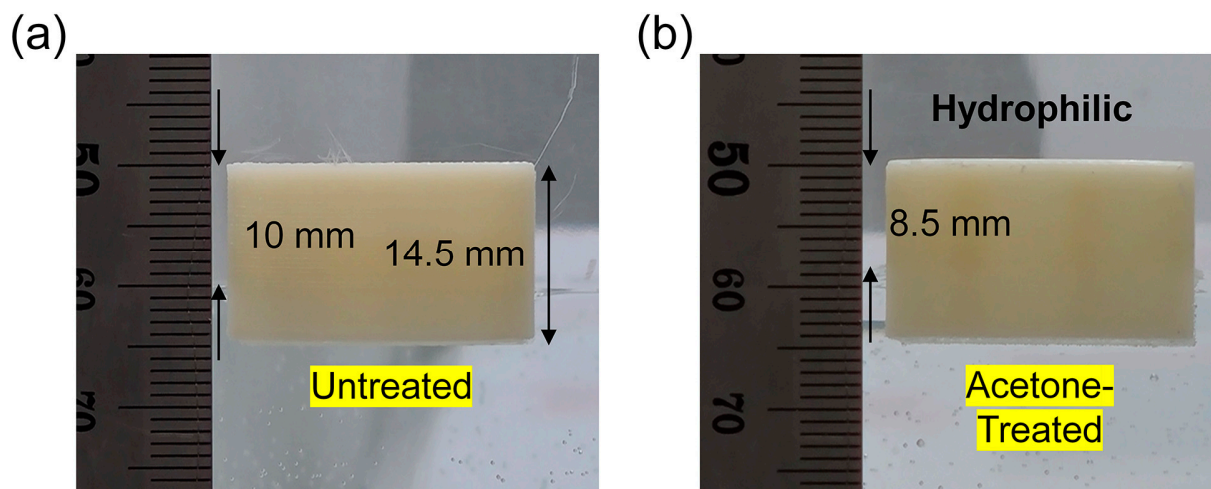


Figure S3. Digital camera images of (a) the untreated and (b) acetone-treated ABS cubes floating on water.

4. Operating principle of single roller-TENG

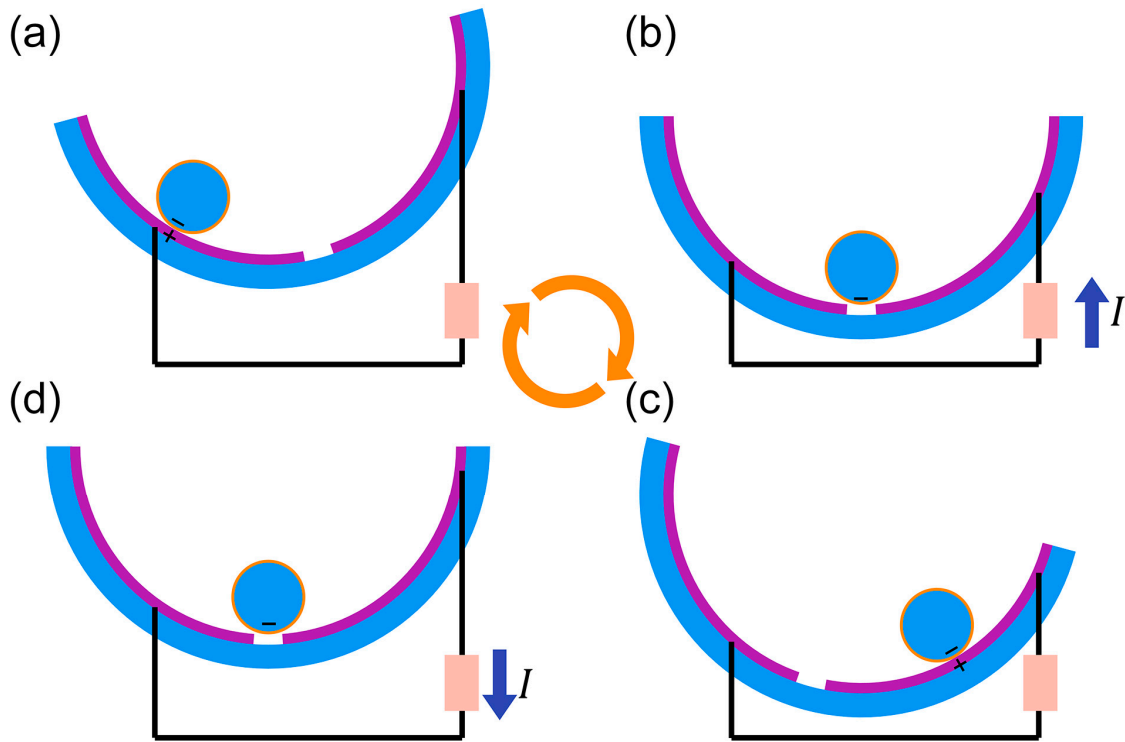


Figure S4. Operating principle of TENG using only one roller presenting a cycle from (a) left electrode-contact, (b) separation, (c) right electrode-contact, and (d) separation.

5. FEM simulation results at different location of the rollers

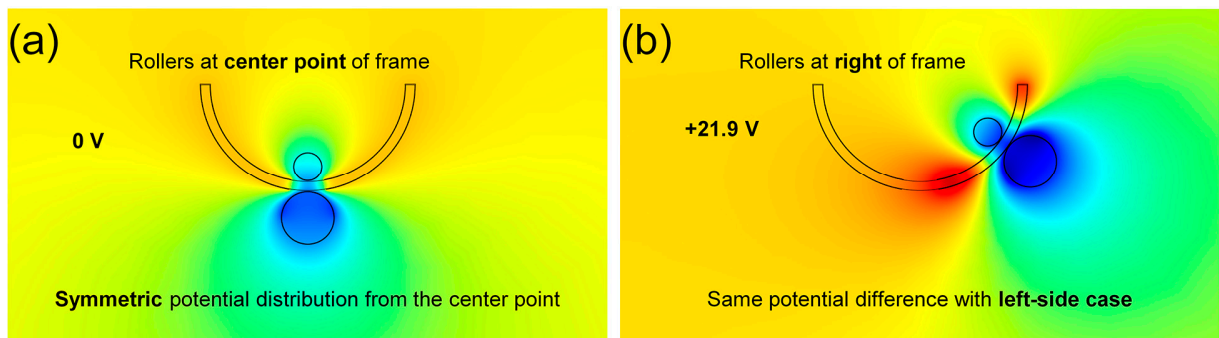


Figure S5. Surface electric potential distribution of the DR-TENG at (a) center position and (b) right of the frame.

6. Effect of the roller diameters in the DR-TENG

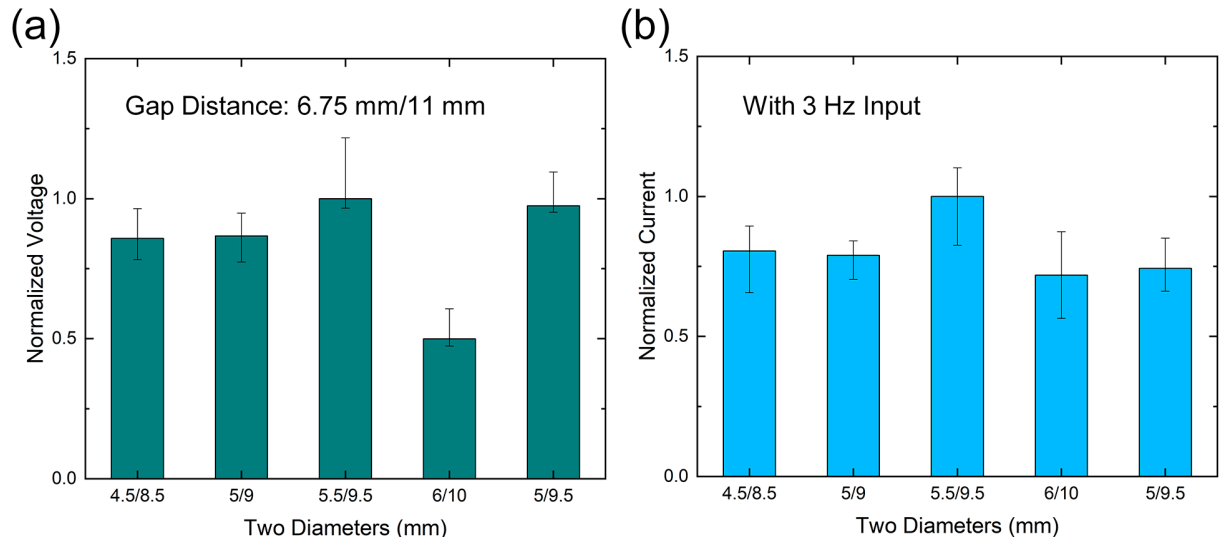


Figure S6. Effect on the (a) output voltage and (b) output current with changing the diameter of the two rollers.

7. Structure and electrical outputs by varying the electrode structures

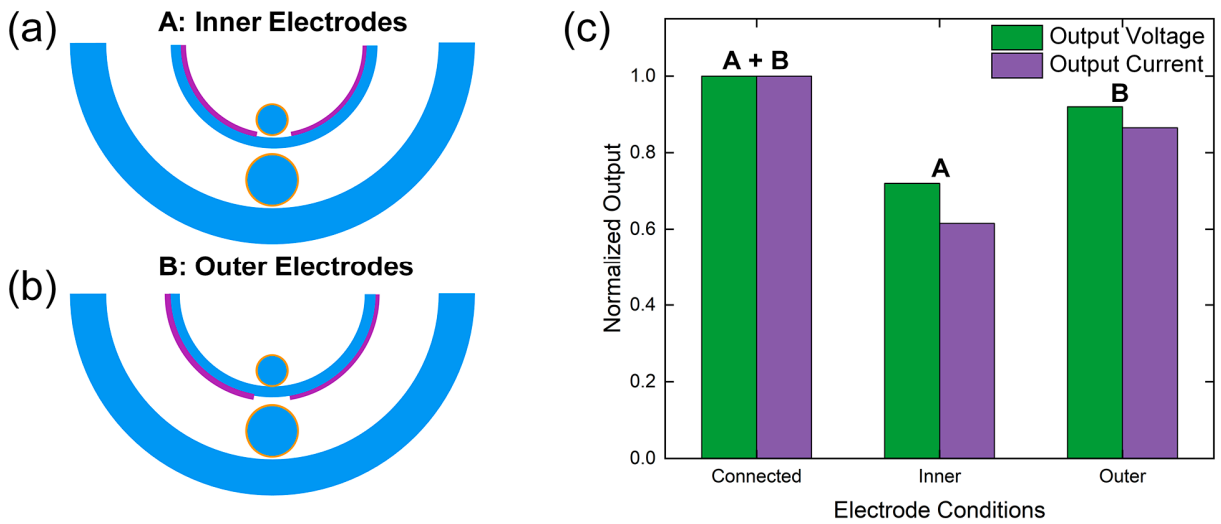


Figure S7. Electrode structures for (a) only inner electrodes and (b) only outer electrodes. (c) Normalized electrical outputs from three different electrode structures.

8. Optimized structure and its parameters

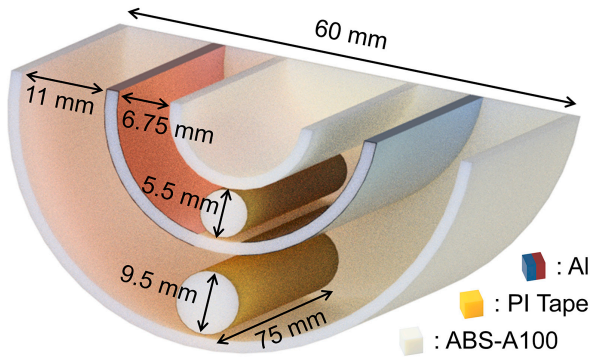


Figure S8. Schematic image for showing the structural parameters of the optimized DR-TENG.

9. Angular dependency of the DR-TENG

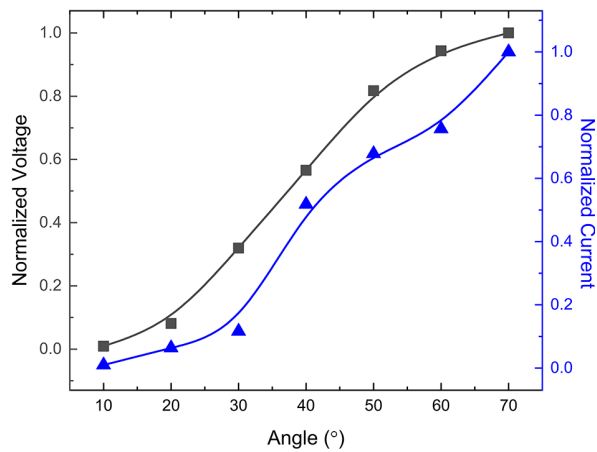


Figure S9. Normalized voltage and current with changing the displacement angle of the DR-TENG.

10. Frequency response of the DR-TENG with three curvatures

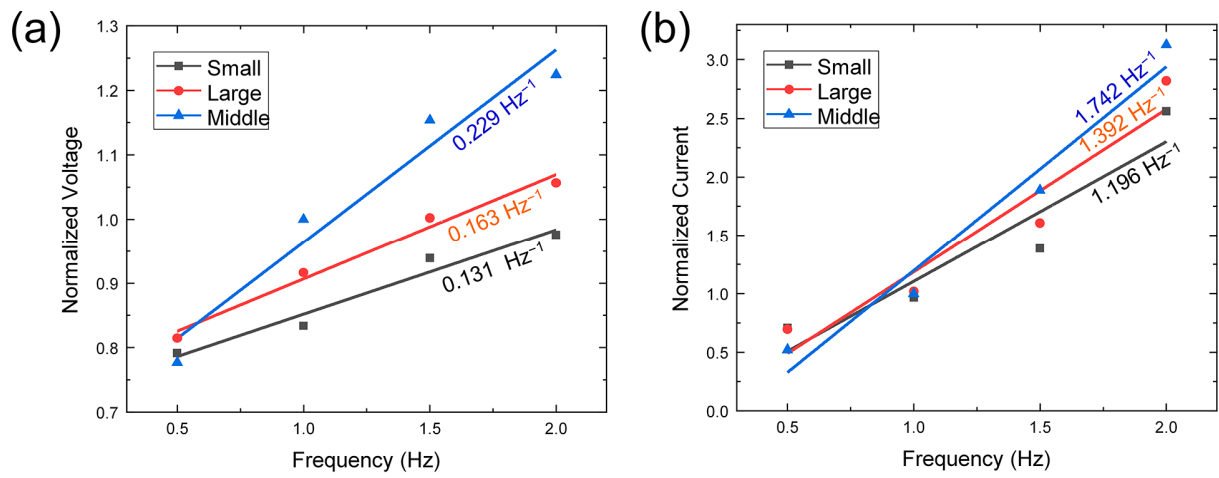


Figure S10. Normalized (a) voltage and (b) current with changing the frequency and device curvature of the DR-TENG.

11. Output comparison with and without the hydrophilic treatment-cases

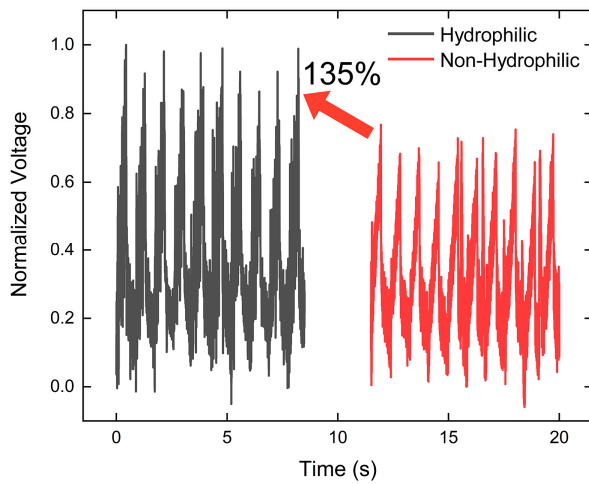


Figure S11. Normalized output voltage from the two surface conditions with and without acetone treatment at the outer ABS of the DR-TENG in the water wave condition.

12. Result of durability test in the water wave condition

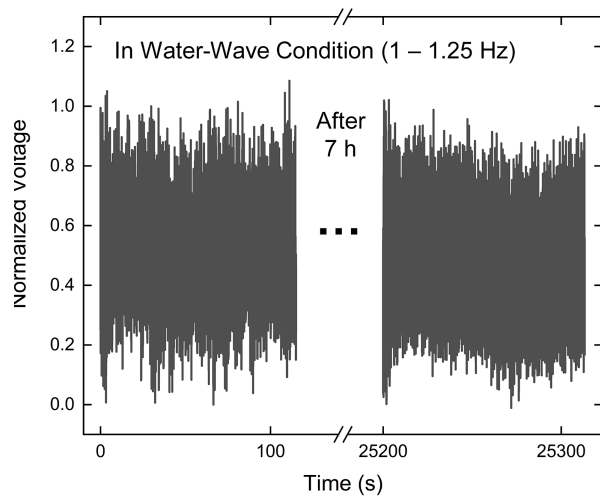


Figure S12. Normalized output voltage from the continuously operating DR-TENG in the water wave-condition for more than 7 hours.

13. Video of illuminating LEDs with DR-TENG

Video S1. Simultaneously illuminating five serially connected green LEDs with double rollers-case.

14. Video of water wave harvesting test in a water bath

Video S2. Water wave energy harvesting with locating the DR-TENG in a water bath.

15. Video of water wave harvesting test in the actual water wave condition with an anchor and operating a LED

Video S3. Water wave energy harvesting with the DR-TENG and an anchor in the actual water wave condition and operating a LED in real time.

16. Video of water wave harvesting test with array structure in the water wave condition

Video S4. Water wave energy harvesting with the 2×2 array structure of the DR-TENG in the water wave condition.