Title:	Development of a Sustainable and Biodegradable Sonchus asper Cotton Pappus Based Piezoelectric Nanogenerator for Instrument Vibration and Human Body Motion Sensing with Mechanical Energy Harvesting Applications
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Abstract:	Energy harvesting from natural resources has gained much attention due to the huge increase in the demand for portable electronic devices and the shortage of conventional energy resources in general. In the present work, the fabrication and realistic applications of a piezoelectric nanogenerator (PENG) using polydimethylsiloxane (PDMS) and the abundantly available, environment-friendly natural fiber Sonchus asper (SA) have been discussed. The biocompatible, low-cost SA fibers were flexible enough and showed high piezoelectric properties as active materials in the study. The SA pappus based piezoelectric nanogenerator demonstrated its ability to convert the harvested biomechanical energy into electrical energy from the various mechanical energy sources available in our environment. The SA pappus/PDMS thin film based piezoelectric nanogenerator (SPENG) fabricated in the laboratory showed colossal output performances (open circuit output voltage, VOC ~81.2 V; short circuit current, ISC ~1.0 μA) by continuous finger impartation. Uniform output performance was also obtained by the application of uniform force on the devices (e.g., ~42 V for 5 N force at 10 Hz frequency). The SPENG was capable to charge a 2.2 μF capacitor to 3.2 V within a short time span (16 s) under continuous finger impartation and illuminate 39 commercial high-power blue LEDs that were connected in series. Thus, the fabricated SPENG can be used as a green and portable energy source to power up portable electronic devices. Apart from this, the SPENG may also be used as a self-powered energy supply for pacemakers or different types of health care units if properly improvised.
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