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Potential for hydropower generation in Sindh, aiming to explore the untapped hydel resources on Nara Main Canal

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Out of 125000 villages in Pakistan, approximately 40000 villages do not have access to electricity. According to a report, 38% of Pakistani population is living without electricity. Sindh, one of the four provinces in Pakistan, stands as vulnerable. Although renewable energy has taken the world by the storm being 22.8% of total electricity mix, little has been its contribution in Pakistan especially in Sindh. The energy generation with hydropower (16%) is comparatively more than Solar and wind together (6.8%). However, Sindh is often considered an outcast for hydropower generation; reason being plain terrain and inadequate flow. This study acts as a testimony for the availability of head and flow enough to generate electricity of around 5.5 MW on Nara Main Canal, at various locations on the canal. The study has used RETScreen model and GIS software in order to evaluate the techno-feasibility and map the project, respectively. RETScreen is Canadian software having the tendency to evaluate the renewables in terms of feasibility. The study has considered an average of a decade for inflation rate and discount being 11% and 6%. Annual analysis on 2014 flow data was done and per Kw cost of the project i.e., 300 was taken from one of the recent studies done on the RD 26 of Nara Main Canal in order to have more realistic results. The life span and debt term of the project was set as 20 years. On average, the study concluded the maximum electricity export rate to be the highest in August and lowest in January. The reason for lowest generation of electricity is because of the closing of canal for 15 to 20 days due to canal maintenance and cleaning. The potential shows that there is renewable solution toward the energy problems of villages in the province of Sindh, Pakistan.

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Continuous scale ozonolysis of terpenoid feedstock; a step towards production of sustainable pharmaceutical product - Laboratory scale demonstration

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Ozonolysis reaction of monoterpene hydrocarbons has been demonstrated in a continuous flow process using micro-reactor technology. Current work reports the conversion of terpenoid feedstock (b-pinene) to nopinone, an intermediate product towards production of active pharmaceutical ingredient (API). The gas-liquid reaction with liquid flow of 0.5-1 ml/min in flow micro reactor with high product selectity (>85%) is successfully demonstrated at room temperature (25^0C) as opposed to -78^0C in batch. Parametric evaluation of feed concentration, operating temperatures, gas/liquid ratios on conversion and product selectivity is reported for process optimization. The risk of potential thermal run-away scenario while performing exothermic reaction and production of explosive ozoides, peroxides and toxic reagents were mitigated by utilizing the small volume micro-reactor technology. The gPROMS process model is formulated as a two-phase gas-liquid flow reaction operating in Taylor flow and corresponding kinetic parameters were estimated and validated with the experimental results. The reaction is very fast with residence time of ~1 sec. An experimental evaluation of product separation and purification using membranes is also reported with 95% separation performance.

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