ABSTRACT

Pakistan has great potential for renewable energy generation to combat the energy crisis and global warming. The current energy mix of Pakistan is highly dependent on fossil fuels that need to be decarbonized according to environmental requirements. Green hydrogen is a viable option to create a sustainable and renewable energy supply for future energy needs. Hydrogen is an energy vector that can replace fossil fuels in the near future due to its carbon free nature and high energy content. Renewable hydrogen production from biomass is viable for agrarian countries like Pakistan. In this study, Product Space Model has been utilized to identify the cost-effective and sustainable hydrogen feedstock. PRODY, EXPY, and RCA are three indicators that are studied based on 23 bio-waste products and seven biomass enriched countries, including Pakistan. Cotton stalk, legume straw, and wheat straw have low-income potential with PRODY values 4421, 6917 and 9986. The highest PRODY values were calculated for wood related products i.e., white oak, cedar wood and beech wood, with PRODY values 41971, 42626, and 45588, respectively. According to PSM, high-income potential generating feedstock (high PRODY value) should be exported for economic gains and cheap feedstock can be utilized for hydrogen production for value addition to gain maximum benefits. Improving the country's export basket will enhance the EXPY value directly related to the economic growth of a country. Pakistan is enriched with crop residues like sugarcane, wheat, rice, cotton, and maize. Hydrogen energy generation potential of major crop residue was also calculated. Results showed that wheat straw has maximum hydrogen potential in Pakistan (2317 MW), followed by Sugarcane bagasse (2237 MW), rice straw (735 MW), maize stalk (435 MW), rice husk (341 MW), and corn cob (44 MW).