Natural rubber: a renewable industrial raw material with negative carbon footprint

K. Annamalainathan* and James Jacob

Rubber Research Institute of India, Kottayam 686 009, India

Using the lifecycle assessment method, we estimated the carbon footprint of natural rubber (NR) produced from 1 ha NR plantation with an economic lifecycle of 27 years and productivity of 1.5 MT dry rubber per ha per year. Lifecycle emissions due to farming operations added up to 26.5 MT of carbon dioxide per ha, most of which resulted from chemical fertilizers. Processing latex into ribbed smoked sheet (RSS) rubber and technically specified rubber (TSR) emitted more CO_2 due to higher energy requirements for drying compared to making concentrated latex (cenex). Thus, lifecycle emissions were the highest for processing RSS (27.8–41.6 MT CO_2) and TSR (13.3–22.9 MT CO_2) and the lowest for cenex (2.7–3.9 MT CO_2). However, the total amount of CO_2 sequestered during the entire lifecycle of the plantation was as high as 500 MT CO_2. This resulted in a negative carbon footprint of approximately –15, irrespective of the type of processed NR. This should make NR a much more preferred raw material for the rubber industry than synthetic rubber which has a much higher carbon footprint. Promoting production and consumption of NR will help decarbonize the global rubber industry and benefit millions of small and marginal NR growers around the world.

Keywords: Carbon dioxide emission, industrial raw material, lifecycle emissions, natural rubber, negative carbon footprint.

intention to reduce the carbon intensity of the economy and attain net zero emission by 2070.

While the obviously large carbon footprint of petroleum-derived SR is generally known, there is a felt need for assessing the carbon footprint of NR even as there exists a substantial amount of data on the high carbon sequestration capacity of NR plantations[6–11]. In the present study, we have done a lifecycle analysis of carbon emissions from a 1 ha NR plantation grown in Kerala, a typical traditional rubber-growing region of India with an estimated productivity of 1.5 tonnes/ha/yr and an economic lifecycle of 27 years, including an immaturity period of seven years. Potential emissions from each agronomic activity, from nursery preparation to felling of old trees at the end of the plantation cycle and processing of latex into different marketable forms of NR, were estimated. Using data on CO_2 sequestration by rubber plantations published earlier, we show that NR has a highly favourable carbon footprint of –15, a significant finding with profound environmental and social implications.

Materials and methods

Sources of emissions associated with the production of latex and processing it into marketable forms of NR, namely ribbed smoked sheet rubber (RSS), technically specified rubber (TSR) and latex concentrate or centrifuged latex