The ethanol impetus

Distilleries have diversified from molasses to a range of feedstocks, enabling blending rates with petrol to more than double to 11.75% in past five years. Modi govt’s differential pricing policy for ethanol has helped

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INDIA’S ETHANOL production programme has come a long way in the past five years, both in terms of the quantities supplied by sugar mills/distilleries to oil marketing companies (OMCs) and the raw material used—both from cane molasses and juice to rice, damaged grains, maize, and down the line, milllets.

Ethanol is basically 95.5% pure alcohol that can be blended with petrol. It is different from the 94% rectified spirit having applications in paints, pharmaceuticals, personal care products and other industries, and 96% neutral alcohol that goes to make potable liquor.

Prime Minister Narendra Modi, at a G20 Energy Ministers’ meet on Saturday, said that India has rolled out 20% ethanol-blended petrol this year and aims to “cover the entire country by 2023.”

Cane options

Till 2017-18 (December-November supply year), sugar mills produced only ethanol from C2-heavy molasses. The cane they crush typically has 13.3-14.4% TSS or total fermentable sugars content. Around 11.5% of it is recovered from the juice with the uncrystallised, non-recoverable 2-2.5% TSS going into so-called C2-heavy molasses. Every one tonne of C2-heavy molasses, containing 40-45% sugar, gives 220-225 litres of ethanol.

But mills instead of extracting the maximum recoverable 11.5%, can produce 9-10% sugar and divert the extra 1.5-2.5% TSS to an earlier B-heavy stage molasses. This molasses, containing 55%-60% sugar, yields 290-320 litres per tonne.

A third route is not to produce any sugar and ferment the entire 13.5-14.4% TSS into ethanol. From crushing one tonne of cane, 80-81 litres of ethanol can thus be obtained, as against 22-24 litres and 10-11 litres through the B-heavy and C-heavy routes respectively.

Feedstock diversification

The table shows ethanol supplies by mills/distilleries to OMCs soaring from a mere 38 crore litres in 2013-14 to an estimated 559 crore in 2022-23. Moreover, there has been a significant diversification of feedstocks from C-heavy to not only B-heavy molasses but also juice, rice, damaged grains, maize, and down the line, milllets.

Ethanol yields from grains are actually higher than from molasses. One tonne of rice can produce 450-480 litres of ethanol, while it is 450-460 litres from broken, damaged grains, 380-400 litres from maize, 385-400 litres from jowar (sorghum) and 365-380 litres from bajra and other milllets. The yields are linked to starch content: 68-72% in rice, 58-62% in maize and jowar, and 55-58% in other milllets.

However, though more ethanol can be produced from grains than molasses, the process is longer. The starch in the grain has to be first converted into sucrose and simpler sugars (glucose and fructose), before fermentation into ethanol by using yeast (Saccharomyces cerevisiae). Molasses already contains sucrose, glucose and fructose.

Year-round production

Some leading sugar companies—including Triveni Engineering & Industries Ltd, DCM Srikanth and Dhanapur Sugar Mills—have installed distilleries with the flexibility to operate on multiple feedstocks and hence, round the year.

Triveni Engineering’s 300,000-litres-per-day (KLD) distillery at Mirak Narangapur in Uttar Pradesh’s Rampur district can use B-heavy molasses from its 6,000 tonnes cane-per-day sugar mill during the crushing season from November to April. During the off-season from May to October, it is able to run on grain, mainly surplus and broken rice sourced from the Food Corporation of India (FCI) and open market.

The multi-feed distillery commissioned in April 2022, has three 2,300 tonnes silos for storing grain, besides facilities for milling into rice, liquefaction (converting starch into glucose and fructose), fermentation (to 15% alcohol), distillation (to 94% spirit) and dehydration (to 99.5% ethanol).

“India’s ethanol programme is no longer reliant on a single feedstock or crop. Earlier, it was molasses and cane. Today, it’s rice, maize and other grains. Diversification of feedstocks will maximise supply fluctuations and price volatility on account of one crop,” said Tarun Sawhney, vice-chairman of Triveni Engineering, which has increased its total distillery capacity from 320 KLPD to 600 KLPD since 2021-22 and plans to further expand to 1,110 KLPD by 2024-25.

The boost

The flexibility and incentive for mills/distilleries to use multiple feedstocks has largely come from the Modi government’s policy of differential pricing. Till 2017-18, the OMCs were paying a uniform price for ethanol produced from any feedstocks.

From 2018-19, the Modi government has been giving higher prices for ethanol produced from B-heavy molasses and whole sugarcane juice/syrup. The idea was to compensate mills for revenues foregone from reduced production or reallocation of resources to ethanol production.

For the 2022-23 supply year, the ex-distributor price of ethanol payable by OMCs has been set at Rs 45.41/litre from C-heavy molasses, Rs 60.73/litre from B-heavy molasses, Rs 66.01/litre from broken/damaged grains, Rs 55.54/litre from broken/damaged grains and Rs 63.50/litre from maize and Rs 58.50/litre from surplus FCI rice.

The stimulants that has given to ethanol production can be seen from the India average blending with petrol touching 11.75% in 2022-23, at against 1.5% in 2013-14 (chart).

The incorporation of new feedstocks for ethanol production can create new demand for grains. Uttar Pradesh is a major sugarcane grower, just as Bihar is in maze. If their farmers were to supply rice, barley and millets as well to distilleries, these two states could well “fuel India” the way Punjab and Haryana/Nadia Madhya Pradesh “feed India.”

The current year might be an exception, with likely pressure on domestic availability generated during alcohol production could pose serious environmental problems, if discharged without proper treatment.

But the new molasses-based distilleries have MVE (multi-effect evaporator) units, where the spent wash is concentrated to about 60% solids. The concentrated wash is used as a boiler fuel along with bagasse (the fibre remaining after crushing sugarcane) in 70:30 ratio. The resultant ash coming out of the incineration boiler in dry form contains up to 28% potash, which can be used fertiliser.

The spent wash from grain distilleries similarly goes into a decanter centrifuge, which separates the liquid from the solid. This is followed by concentrating the liquid in MEB units and drying it along with the waste caking from the decanter. The resultant by-product, DMC or distiller’s dried grain with solubles, is sold as animal feed.