

## CHEMICAL COMPOSITION OF BREWERY WASTE\*

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*Brewery waste was evaluated for the proximate principles and fibre fractions. The dry matter (DM) content of brewery waste was  $29.15 \pm 0.43$ . Crude protein (CP), crude fibre (CF), ether extract (EE), total ash (TA) and nitrogen free extract (NFE) content of brewery waste were  $24.34 \pm 0.60$ ,  $19.62 \pm 0.31$ ,  $5.19 \pm 0.18$ ,  $5.76 \pm 0.14$  and  $45.07 \pm 0.79$  per cent, respectively, on DM basis. The gross energy (GE) content of brewery waste was  $3543.52 \pm 46.33$  kcal/kg on DM basis. The neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, cellulose and lignin contents of brewery waste were  $54.64 \pm 0.62$ ,  $24.68 \pm 0.92$ ,  $29.96 \pm 1.03$ ,  $13.14 \pm 0.35$  and  $7.12 \pm 0.26$  per cent, respectively on DM basis. It is concluded that brewery waste is the best suited agro industrial byproduct for ruminants because of its high nutritive value such as crude protein, crude fibre and NFE (readily available energy) content with low cost.*

**Key words:** Brewery waste, proximate composition, fibre fractions, ruminants

A wide range of agro-industrial byproducts are available in large quantities which have considerable nutritional potential. Brewery waste (Brewer's grains) is a typical example of such unrealized potential. Brewery waste is a byproduct of ethanol industry which uses cereal grains as feed stock. When grain is fermented to produce ethanol, primarily the starch is utilized, leaving behind a protein rich residue that can be used in livestock diets. As the ethanol industry grows, greater quantities of distiller's grain will become available for use as animal feed at reasonable cost. Distiller's grain can be exploited to utilize as an unconventional feed resource in ruminants especially milch animals in tropics. Hence, the present study was planned

to estimate the proximate composition and fibre fractions of the brewery waste.

About 500 g each of wet brewery waste was collected from Osho Farm, Pattikad, Thrissur, Kerala at six different time periods to study the chemical composition. Each sample was dried in an oven at 60°C for 48 h and ground to pass through 1mm sieve. The ground samples were preserved in airtight containers for further chemical analysis. Brewery waste samples were analyzed for dry matter (DM), organic Matter(OM), crude protein (CP), ether extract (EE), crude fibre (CF), total ash (TA) and acid insoluble ash (AOAC, 1990). Fibre fractions such as NDF, ADF, hemicellulose, cellulose and lignin were analyzed (Van Soest *et al.* 1991). The

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samples of brewery waste were analyzed for their gross energy content using bomb calorimeter (Parr Instrument Company, U.S.A)

The data on the chemical composition and fibre fractions of the brewery waste are given in Table 1. The DM content of brewery waste was  $29.15 \pm 0.43$  per cent. This is in agreement with Murdock *et al.* (1981) and Dong and Ogle (2003) who reported DM contents ranging from 26 to 31 per cent. Dhiman *et al.* (2003) reported a DM value of 33.6 per cent, while Rogers *et al.* (1986) and Belibasakis and Tsirgogianni (1996) reported lower DM values of 18.6 and 19.3 per cent, respectively. The CP content of brewery waste was  $24.34 \pm 0.60$  per cent on DM basis. Murdock *et al.* (1981), Rogers *et al.* (1986), Belibasakis and Tirgogianni (1996) and Dong and Ogle (2003) also reported similar CP values ranging from 23.4 to 27.4 per cent. A higher (30.1 per cent) and lower (20.0 per cent) CP values were reported by Crickenberger and Johnson (1982) and Ranjhan (1998) respectively. The EE content of brewery waste was  $5.19 \pm 0.18$  per cent on DM basis and it was found lower than the value of 10.6 per cent reported by Dong and Ogle (2003). The TA content of brewery waste was  $5.76 \pm 0.14$  per cent on DM basis and it was found higher than the values (3 to 5 per cent) reported by Ranjhan (1998) and Dong and Ogle (2003). The NFE content of brewery waste was  $45.07 \pm 0.79$  per cent on DM basis. Dong and Ogle (2003) also reported similar NFE values ranging from 41.2 to 48.1 per cent, where as Ranjhan (1998) reported higher value of 53.9 per cent. The acid insoluble ash content was  $4.42 \pm 0.15$  per cent on DM basis. The gross energy content of brewery waste was  $3543.52 \pm 46.33$  kcal/kg.

NDF content of brewery waste was  $54.64 \pm 0.62$  per cent on DM basis. Murdock *et al.* (1981) and Dong and Ogle (2003) also reported similar NDF values ranging from 50 to 55 per cent. Higher NDF value of 70 per cent was reported by Dhiman *et al.*

(2003). On contrary, Belibasakis and Tsirgogianni (1996) reported lower NDF values between 40 to 50 per cent. ADF content of brewery waste was  $24.68 \pm 0.92$  per cent on DM basis which is higher than 20 per cent as reported by Murdock *et al.* (1981) and Rogers *et al.* (1986). However, Dhiman *et al.* (2003) reported higher ADF value of 27.7 per cent and Dong and Ogle (2003) reported lower value of 17.5 per cent. The hemicellulose and cellulose contents of brewery waste were  $29.96 \pm 1.03$  and  $13.14 \pm 0.35$  per cent, respectively on DM basis in the present study. Valverde (1994) reported a higher hemicellulose content of 39 per cent for brewer's grain. The lignin content of brewery waste was  $7.12 \pm 0.26$  per cent on DM basis which is higher content compared to the value of 4 to 5 per cent as reported by Murdock *et al.* (1981).

The differences in the chemical composition of brewery waste may be attributed to the nature of grains (barley, maize and rice) used for beer making as raw material, their inclusion level and the type of channels they pass through. Apart from the above mentioned reasons, variations in the nutritive value of the grains used, strain variation, period of fermentation, processing techniques and analytical procedures followed might have contributed for their variations in the chemical composition of brewery waste between different investigators.

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**Table 1.**  
**Chemical composition of brewery waste\***  
**(% DMB)**

Item	Brewery waste
Dry matter	29.15 ± 0.43
Organic matter	94.25 ± 0.14
Crude protein	24.34 ± 0.60
Ether extract	5.19 ± 0.18
Crude fibre	19.62 ± 0.31
Total ash	5.76 ± 0.14
Acid insoluble ash	4.42 ± 0.15
Nitrogen free extract	45.07 ± 0.79
Neutral detergent fibre	54.64 ± 0.62
Acid detergent fibre	24.68 ± 0.92
Hemicellulose	29.96 ± 1.03
Cellulose	13.14 ± 0.35
Acid detergent lignin	7.12 ± 0.26
Gross energy ** (kcal/kg)	3543.52 ± 46.33

\* Mean of four values ± SE

\*\*Gross energy determined using Bomb calorimeter  
(Parr Instrument Company, U.S.A)

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