

Effect of Steam Explosion of Crop Residues on Chemical Compositions and Efficient Energy Values

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Abstract : In China, quite low proportion of crop residues were used as feedstuff because of its poor palatability and low digestibility. Steam explosion is a physical and chemical feed processing technology which has great potential to improve sapidity and digestibility of crop residues. To investigate the effect of the steam explosion on chemical compositions and efficient energy values, crop residues (rice straw, wheat straw and maize stover) were processed by steam explosion (steam temperature 120-230°C, steam pressure 2-26kg/cm², 40min). Steam-exploded crop residues were regarded as treatment groups and untreated ones as control groups, nutritive compositions were analyzed and effective energy values were calculated by prediction model in INRA (1988, 2010) for both groups. Results indicated that the interaction between treatment and variety has a significant effect on chemical compositions of crop residues. Steam explosion treatment of crop residues decreased neutral detergent fiber (NDF) significantly ($P < 0.01$), and compared with untreated material, NDF content of rice straw, wheat straw, and maize stover lowered 21.46%, 32.11%, 28.34% respectively. Acid detergent lignin (ADL) of crop residues increased significantly after the steam explosion ($P < 0.05$). The content of crude protein (CP), ether extract (EE) and Ash increased significantly after steam explosion ($P < 0.05$). Moreover, predicted effective energy values of each steam-exploded residue were higher than that of untreated ones. The digestible energy (DE), metabolizable energy (ME), net energy for maintenance (NEm) and net energy for gain (NEg) of steam-exploded rice straw were 3.06, 2.48, 1.48 and 0.29 MJ/kg respectively and increased 46.21%, 46.25%, 49.56% and 110.92% compared with untreated ones ($P < 0.05$). Correspondingly, the energy values of steam-exploded wheat straw were 2.18, 1.76, 1.03 and 0.15 MJ/kg, which were 261.78%, 261.29%, 274.59% and 1014.69% greater than that of wheat straw ($P < 0.05$). The above predicted energy values of steam exploded maize stover were 5.28, 4.30, 2.67 and 0.82 MJ/kg and raised 109.58%, 107.71%, 122.57% and 332.64% compared with the raw material ($P < 0.05$). In conclusion, steam explosion treatment could significantly decrease NDF content, increase ADL, CP, EE, Ash content and effective energy values of crop residues. The effect of steam explosion was much more obvious for wheat straw than the other two kinds of residues under the same condition.

Keywords : chemical compositions, crop residues, efficient energy values, steam explosion

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