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Effect of Chemical Treatments for Cellulosic Plants on Some Macro Minerals

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Abstract
We treated barley straw with sodium hydroxide, ammonium hydroxide and urea to improve the nutrition efficiency. Some macro minerals "calcium, potassium and phosphor were measured. No effect for chemical treatments on Ca, K and P (%). Potassium content (%) was 0.033, 0.038, 0.042 and 0.035 for untreated straw or treated with NaOH, NH_4OH and Urea. Phosphor content (%) was 0.6, 0.65, 0.89 and 0.82, while calcium (%) was 0.90, 0.95, 0.88 and 0.93 for untreated straw or treated with NaOH, NH_4OH and Urea respectively. In conclusion: No effects for treated straw with NaOH, NH_4OH or urea on macro minerals like Ca, K and P and in respectively for other minerals.
Key word: Chemical treated straw, calcium, potassium, phosphor, macro elements.

1-Introduction

Highly cellulosic plants like barley straw are widely uses for ruminants feeding with high crude fiber contents and low in other nutrients like nitrogen, fats, soluble carbohydrate. So, researchers treated straw with different treatments: physical, chemical and biological treatments to improve nutritive value Hassan and Tawffek (2009). Straw introduced to ruminants in a winter and in rear feed stuff season. Its agricultural byproduct for gramineae family crops production. Chemical treatments affect positively to ligno-cellulose/hemicelluloses linkage but it may negatively to other component (Al-Ani, 1986). Minerals, macro and trace minerals, important for microbial growth efficiency, digestibility and intake of forage, movement of calcium ion (Ca^{+2}) into and out of cytoplasm make a signal for many cellular processes. Most minerals received from diets. However, more details are required in order to clarify the effects of traditionally chemical treated like sodium hydroxide, ammonium hydroxide and urea for cellulosic plants.

2- Materials and Methods

The effect of three chemical treatments for barley straw: sodium hydroxide (NaOH), ammonium hydroxide (NH_4OH) and urea (NH_2-CO- NH_2) were investigated. Chemical treated straw was done using sodium hydroxide solution 4% as straw dry matter basis, ammonium hydroxide solution 23% and urea solution (N 3.3% as straw dry matter basis) at 39˚c and 60% humidity for 30 days for all treatments (Hassan et al., 1998). Putting barley straw in plastic pans with water to give 60% humidity and mixed well. Added 4% sodium hydroxide solution as a percent 1:1 with continuous mixing to mixture then put it in nylon bags and closed well for 30 days. After that, opened to dried in plastic pens and sampled for further analysis. The same thing when treated barley straw as dry matter basis with ammonium hydroxide or urea (3.3% N).

2-1-Chemical Analysis

Samples of treated/untreated barley straw were dried at 60°c for 48 hour before chemical analysis, then ground through a 1mm screen for chemical analysis. Dry matters (DM), organic matter (OM) and total nitrogen (TN) were determined according to A.O.A.C. (2005). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined by the method of Goering and Van Soest (1970), Hemicellulose was estimated as the difference between NDF and ADF, Cellulose was estimated as the difference between ADF and ADL (table1). Determination of some macro minerals which it calcium (Ca), potassium (K) and phosphor (P) was done according to Tandon(2005) using quantitive procedure for calcium, colorimetrically method for phosphor at the standard curve (fig. 1.) with absorption at 882nm. in LKB,Bio chrom\ Novaspec spectrophotometer and ignition method for potassium with standard curve (fig.2.).

Table1. Chemical composition for untreated and treated straw

Chemical Composition	Untreated Straw	Treated Straw With NaOH	Treated Straw With NH4OH	Treated Straw With Urea
Dry Matter (gm/kg)	943.228	925.03	900.93	935.57
ASH (%)	14.187	10.889	10.787	12.870
Organic Matter (%)	80.136	81.604	79.306	80.687
Nitrogen (%)	0.297	0.301	1.408	1.197
NDF (%)	78.556	66.936	74.337	74.356
ADF (%)	47.985	45.591	47.708	46.849
Cellulose (%)	35.506	39.627	38.763	36.125
Hemicellulose (%)	30.571	21.345	26.629	27.507
(ADL)Lignin (%)	12.479	5.964	8.945	10.724
NDF= Neutral detergent fiber, ADF=Acid detergent fiber, ADL=Acid detergent lignin				

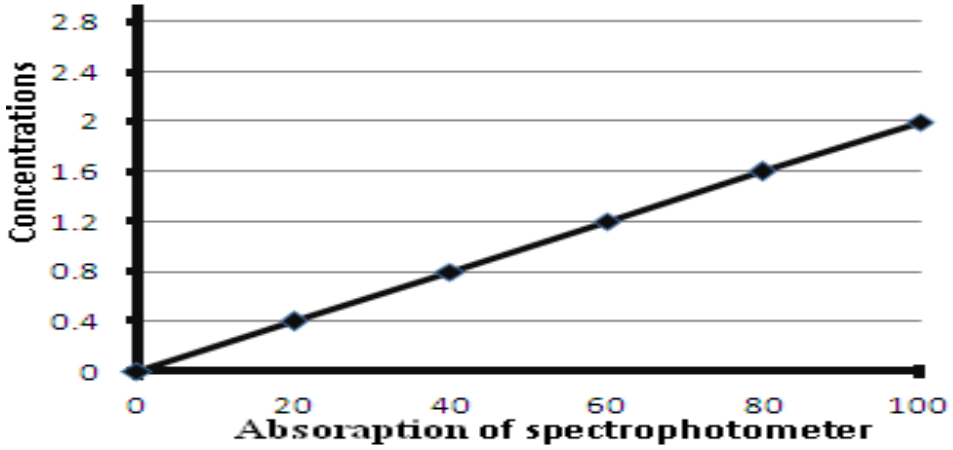

Fig. 1. Standard curve for phosphor standard solution

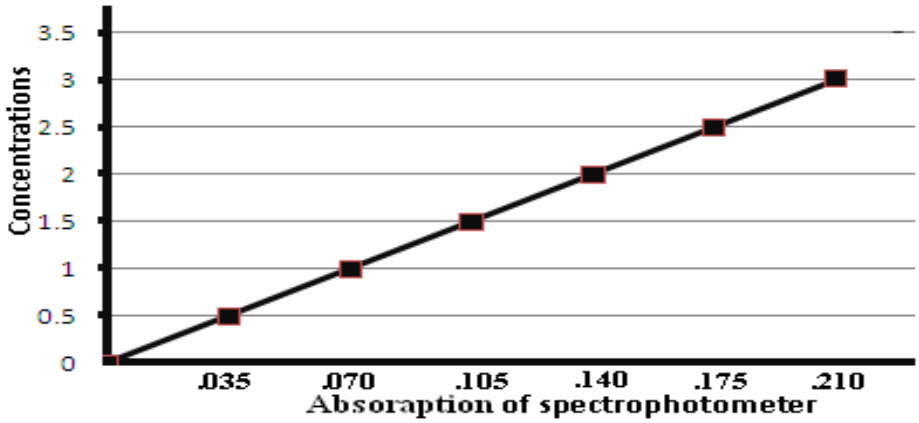

Fig. 2. Standard curve for potassium standard solution

2-2-Statistical Analysis

Data was statistically analyzed with completely randomized design (CRD) (2006). Duncan's multiple range tests was used to determine the significance of differences between treatments means (1955).

3-Results and Discussion

3-1- Effects of NaOH Treated

The content of calcium, potassium and phosphor for untreated straw or treated with sodium hydroxide are presented in fig.(3). Treated barley straw with NaOH was no effects on the minerals content comparing with untreated. There was little increasing in these macro minerals for treated barley straw but it wasn't significant. Strong alkaloids significantly effect on glycoside linkage and lignin-cellulose/hemicelluloses ester bounds (Zhu et al., 2005) with no effects on other components.

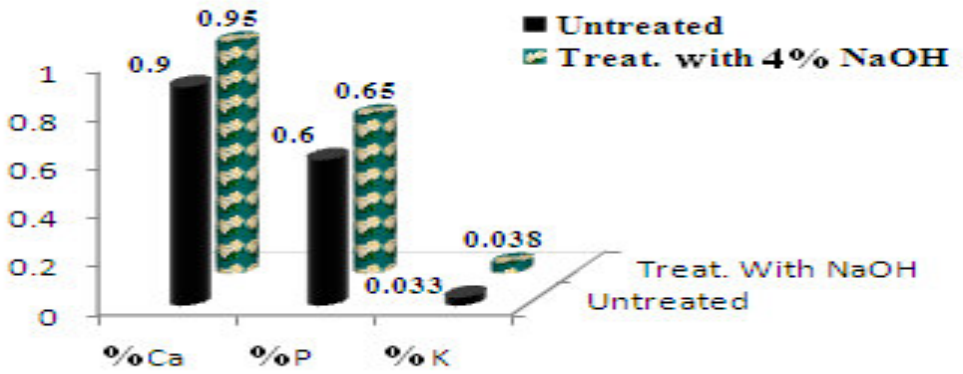

Fig.3. Ca, P and K contents (%) for untreated straw and treated with NaOH

Treating rice straw with calcium hydroxide improves feeding value and raises calcium content compared to untreated (Fadel Elseed, 2003; Wanapat et al., 2009). NaOH treatment increased degradability and palatability of treated straw (Vadiveloo, 2000). The increases for calcium in blood plasma may increase abortion in ewes (Aytekin and Aypak, 2011). So, this real problem increases when treated straw with calcium hydroxide. Feeding ruminants treated straw with NaOH lead to increase renal excretion of phosphorus (Becker et al., 1984).

3-2- Effects of NH_4OH Treated

The main effect of ammonium hydroxide treatments on calcium, potassium and phosphor was measured and the resulted in fig. (4). All results wasn't significant with little increasing in phosphor and potassium value in treated barley straw comparing with non treated. The supply of minerals needed to meet requirements of rumen microorganisms which it more important from availability of energy for fermentation (Durand at al., 1988) and ruminants have to feed roughages in daily feeding about 60% from all diets. So, it's important to added minerals as supplemented with ruminants daily feeding as additives to the concentrate or mixing with water or submitted as blocks in the pasture (Wu et al., 2005).

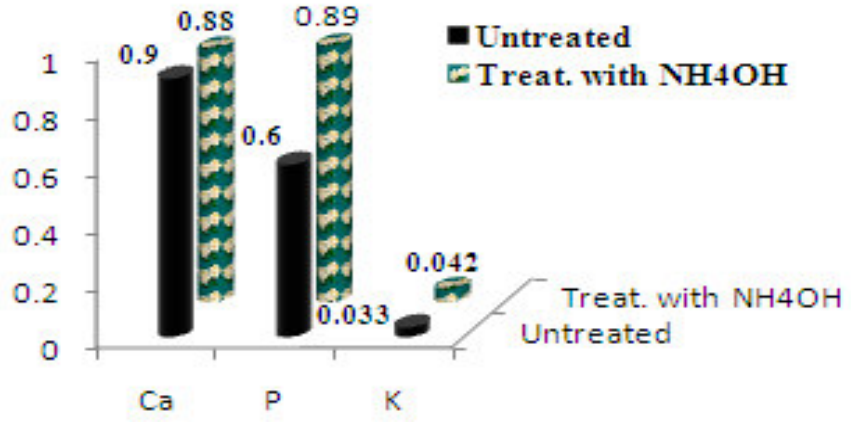

Fig.4.Ca, P and K contents (%) for untreated straw and treated with NH_4OH(3%N)

Most of low quality roughages needed to minerals as supplemented when administrated to ruminants for improving rumen environmental especially the efficiency of microorganisms growth (Milad et al. 2010).

3-3- Effects of Urea Treated

Treated straw with urea solution (3.3% N) as a proportion 1:1 dry matter straw: urea solution 3.3% N resulted in fig. (5). The dehydration of urea with urease into two groups of ammonia as following equation:

$$NH_2 - CO - NH_2 \xrightarrow[\text{Urease}]{\mathbf{H_2O}} 2NH_3 + CO_2$$

The resulted weak base (ammonia) effects on organic materials. So, there were no significant differences between untreated and treated straw with urea on macro minerals. While the treated with urea leading to significant increases in proportion of nitrogen content and agree with Nisa et al. (2010) when treated wheat straw with urea and molasses, without affecting the milk yield and its quality or mineral contents for early lactating buffaloes.

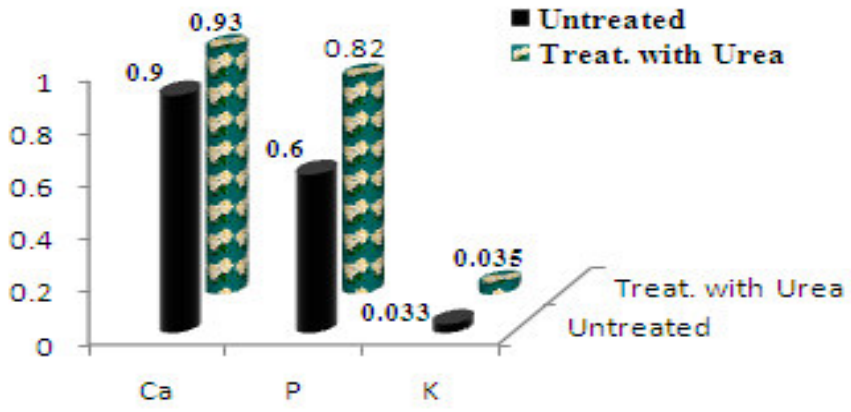

Fig. 5. Ca, P and K contents (%) for untreated straw and treated with urea

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