ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 06, pp.33185-33188, June, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECT ON DENSİTY AND DRY MATTER LOSSES OF VACUUM İN VACUUM-PACKED POLYTHENE BAGS SİLAGE

***Fulya TAN and Nurçin BÜYÜKTOSUN**

Fulya TAN. Namık Kemal University, Agriculture Faculty, Biosystem Engineering Dep. Tekırdag./TURKEY.

ARTICLE INFO

Article History:
Received 24th March, 2016
Received in revised form
23rd April, 2016
Accepted 16th May, 2016
Published online 30th June, 2016

Key words:

Vacuum-packed bag silage,
Density, Dry matter loss,
Corn silage.

ABSTRACT

The objectives of this study were determined to effect of vacuum treatments and to measure densities and dry matter losses in vacuum-packed polythene bags silage. Maize *(Zea mays* L.) was harvested at two maturity stage (30% and 45% dry matter) and ensiled in packages. In the experiment was made 3 vacuum treatments (0.07mPa, 0.1mPa and -0.1mPa). And vacuum-packing machine a model CAS CVP 260 PD type was used. In all experiments, the chopped material was packed into polythene bags (dimensions 200x250 mm). Three different types polythene bags (PA/PE, BOPA/PE and OPP/PE/EVOH/PE) were examined. Vacuum-packed bag silages were opened after 15 days, 45 days,80 days and at the end of one year of ensiling. Results showed that, average dry matter loss in the vacuum-packed bag silages was 8.85, 10.96, and 6.08% after end of the one year, respectively. The highest dry matter loss was BOPA/PE type bags. Dry matter loss affected by at the stage of maturity and vacuum treatments ($P<0.05$). Density ranged from 0.11 to 0.34 g cm^{-3}. At all bag silages density increased linearly with increasing moisture while decreased with increasing vacuum level ($P<0.05$).

Citation: Fulya TAN and Nurçin BÜYÜKTOSUN, 2016. "Effect on density and dry matter losses of vacuum in vacuum-packed polythene bags silage", *International Journal of Current Research*, 8, (06), 33185-33188.

INTRODUCTION

Ensiling is a common preservation method for forage crops. Different technologies are used in silage making. Vacuum-packed polythene bags silage are preferred in Turkey recently. Because, this silages has a longer storage period and higher nutrient content. Vacuum-packed bag silages can be variable in size (1-300 kg each bag). Variable packet size is ideal for small and medium-sized livestock enterprises. Farmers usually prefer to make a packet size of 50 kg. of There are both stations and mobile types in the market of the foragers vacuum type. There is not enough research for vacuum-packed polythene bags silage. Toruk and Kayısoglu (2008) reported that silage quality at vacuum-packed bag silages were increased according to increasing vacuum levels. They made bag silages (3 kg each bag) at different vacuum level. Silage quality were significantly affected by vacuum treatment. Büyüktosun and Tan (2015) also reported effective physical properties of the polythene (PE) bag on the silage quality. They examined different type PE bags which produced in Turkey. Silage quality scores were high in the examined PE bag types.

Corresponding author: Fulya TAN,
Fulya TAN. Namık Kemal University, Agriculture Faculty, Biosystem Engineering Dep. Tekırdag./Turkey.

Therefore they suggested that PE bag type with the lowest cost for used application. The density and dry matter loss for the different types of silages has been identified by various researchers. Rony *et al*. (1984) reported a 6.1% DM loss and Wallentine (1993) 2.5% loss in corn silage under unspecified conditions. Muck and Holmes (2001) found a 14.2% DM losses for pressed bag silos. They (2002) and Savoie (2006) indicated a relationship between DM loss and density. DM losses in bunker silos was found a 9-12% for grass, lucerne and maize silage by Köhler *et al*. (2013). Kennedy (1987) reported densities in bag silos are variable. This bag silos is quite different from the vacuum-packed bag silages used in our study. Vacuum-packed polythene bags silage is a new technology. There is not enough research for vacuum-packed polythene bags silage. Small and medium-sized consumers have started to prefer this type of silage because of its many advantages. The objectives of this study were to measure effects on densities and dry matter losses of vacuum in vacuum-packed polythene bags silage and to determine the best type of bag and the vacuum level.

MATERIALS AND METHODS

Maize (Pioneer 32K61) was harvested at two maturity stages (30 and 45% dry matter) and chopped by a forage harvesting

machine (JD 7450). The chopped materials were brought to the laboratory where into polythene bags were vaccummed. Three vacuum applications were done in the study. Vacuum-packing machine a model CAS CVP 260 PD type was used (Fig.1).

Figure 1. Vacuum-packing machine (CAS CVP260 PD)

Table 1 Shows vacuum treatments were arranged at three different vacuum levels.

In all experiments, the chopped material was packed into polythene bags (dimensions 200x250 mm). Three different types polythene bags (PA/PE, BOPA/PE and OPP/PE/EVOH/PE) were examined. Polythene bag types used in the market were selected. General characteristics of the plastic used in the experiment were shown in Table 2. Forages were filled in plastic bags. All bags were weighed and placed indoors at room temperature which varied between 16 and 22 ^{o}C. The weights of all packaged silage was recorded. Average densities for the bags were calculated based on weight ensiled. Vacuum-packed bags of silage density values were calculated according to the graduated cylinder method (Cai *et al*., 1997). Vacuum-packed polythene bag silages were opened after 15 days, 45 days, 80 days and at the end of one year of ensiling.

Chemical analysis

All the samples were analyzed for moisture content. The dry matter content of the silages were determined by oven drying at 103 ^{o}C during 24 h (ASAE Standarts, 2002).

Istatistical analysis

All bags were opened for analysis after 15 days, 45 days, 80 days, at the one year of ensiling. All data were analyzed by SPSS.

RESULTS AND DISCUSSION

DM loss

Average dry matter losses for these bag silages at the end of one year storage period are shown in Table 3. The low dry matter loss both harvest moisture (30%-45%) OPP/PE/EVOH/PE, PA/PE and BOPA/PE was in the bag type, respectively. DM losses had a negative significant correlation coefficient with the bag type for both harvest moisture *(P<0.01; r=-0.510)*. Bag types, regardless of the material moisture during both maturity also showed similar results. But, DM losses was different in each bag types. No correlation between the DM losses and vacuum treatment of bag silos for both harvest moisture.

Table 1. Applied vacuum pressure and time

Vacuum pressure (mPa)	Time (s)
0,07	10
0,1	15
-0,1	25

Table 2. General characteristics of the plastic used in the experiment (200x250 mm)

	PA/PE	BOPA/PE	OPP/PE/EVOH/PE
Thick (µ)	90	90	90
Intensity (g.m^{-2})	87	82.8	90.18
Elongation (%)	370	95 ASTM D882	95 ASTM D882
Yield (m^{-2}.kg)	-	12.07	11.08
Structure of product	Poliamid/Low Density Polietilen	Bioriente Polyamide / Low Density Polietilen	Bioriented Polypropylene // Low Density Polietilen / Ethylene Vinyl Alcohol
O_2 permeability (cc m^{-2} day)	41	28	1.13
CO_2 permeability (cc m^{-2} day)	160	150	12

Table 3. Dry matter losses at the different polythene (PE) bag types and vacuum applications (%30-%45 DM)

Types PE bag	Vacuum (mpa)	Losses	
		%30 DM ($\bar{x}$) ± S	% 45 DM ($\bar{x}$) ± S
PA/PE	0.07	8.07±0.03	10.39±0.03
	0.1	8.82±0.02	9.67±0.05
	-0.1	7.26±0.02	8.89±0.01
		8.05±0.66 **b**	9.65±0.65**b***P<0.05*
			8.85±2.21 **b***P<0.05*
BOPA/PE	0.07	11.08±0.02	10.13±0.03
	0.1	8.77±0.01	12.66±0.06
	-0.1	10.94±0.04	12.19±0.00
		10.26±1.12 **c**	11.66±1.16 **c***P<0.05*
			10.96±1.32 **c***P<0.05*
OPP/PE/EVOH/PE	0.07	5.44±0.04	6.20±0.02
	0.1	6.24±0.04	6.26±0.01
	-0.1	6.19±0.01	6.17±0.01
		5.95±0.389 **a**	6.21±0.04 **a***P<0.05*
			6.08±0.29 **a***P<0.05*
	0.07	8.19±2.44 **c**	8.90±2.02 **a**
	0.1	7.94±1.27 **a**	9.53±2.77 **c***P<0.05*
	-0.1	8.13±2.15 **b**	9.08±2.61 **b**
		8.09±1.94	9.17±2.40

a,b; Significant at P<0.05

Table 4. Density at the different polythene (PE) bag types and vacuum applications (%30-%45 DM)

Types bag	Vacuum (mpa)	Density (g cm^{-3})	
		%30 DM ($\bar{x}$) ± S	% 45 DM ($\bar{x}$) ± S
PA/PE	0.07	0.23±0.04	0.19±0.02
	0.1	0.18±0.01	0.15±0.07
	-0.1	0.12±0.03	0.11±0.05
		0.17±0.02 **a**	0.15±0.04 **a***P<0.05*
			0.16±0.03 **a**
BOPA/PE	0.07	0.34±0.00	0.27±0.01
	0.1	0.26±0.10	0.22±0.05
	-0.1	0.19±0.01	0.17±0.02
		0.26±0.05 **b**	0.22±0.02 **b**
			P<0.05
			0.24±0.03 **b**
OPP/PE/EVOH/PE	0.07	0.27±0.01	0.25±0.01
	0.1	0.23±0.10	0.21±0.03
	-0.1	0.14±0.05	0.13±0.01
		0.21±0.05 **ab**	0.19±0.01**ab***P<0.05*
			0.20±0.03 **b**
	0.07	0.28±0.02 **c**	0.23±0.04 **c**
	0.1	0.22±0.07 **b**	0.19±0.05 **b***P<0.05*
	-0.1	0.15±0.03 **a**	0.14±0.02 **a**
		0.21±0.04	0.18±0.03

a,b; Significant at P<0.05

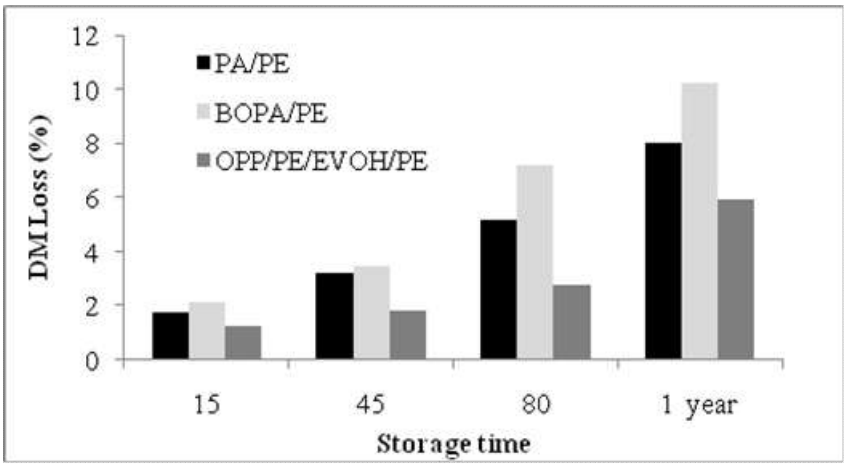

Figure 2. Avarage DM losses of the bag silage at different storage time

Average losses were 8.09 % losses at 30% at the maturity stage and 9.17 % losses for 45% at the maturity stage. DM losses increased with decreasing moisture *(P<0.01; r=-0.583*). Our results are similar to DM loss (8.4 %) measured by Muck and Holmes (2001). Savoie (2006) found the higher dry matter loss. DM loss were 25.9, 15.9 and 9.1% for mini silo in different densities. In this study, DM loss measured at vacuum-packed polythene bags silages lower than mini silos. But, Rony *et al*. (1984) the lower loss (% 6.1) and Wallentine (1993) also reported 2.5% loss in corn silage under unspecified conditions.

The DM losses determined for storage time (15, 45, 80 days and one year) are presented in figure 2. The lowest DM loss and the lowest standard deviation was in the OPP/PE/EVOH/PE type bag silage at all of the storage time. The highest DM loss was in BOPA/PE type bag silage. Muck and Holmes (2001) reported a 14.2% avarage DM losses for pressed bag silos and Köhler *et al*. (2013) found 9-12% DM losses for grass, lucerne and maize silage in bunker silos. These results are lower than our results.

Density

Average density for these bag silages at the end of one year storage period are shown in Table 4. Average dry matter densities were changed according to vacuum treatments. Density had a negative significant correlation coefficient with the vacuum level for both harvest moisture *(P<0.01;r =-0.766)*. Vacuum had a significant effect in increasing the density of bag silages 0.28 g cm^{-3} at 0.07 mPa, 0.22 g cm^{-3} at 0.1 mPa, 0.15 g cm^{-3} at -0.1 mPa. In vacuum-packed silage, dry matter density decreased linearly with increasing vacuum level. Generally the highest densities were at 0.07 Mpa and the lowest densities at -0.1 mPa vacuum treatment according to tukey HSD test. The lowest density was 0.11 g cm^{-3} at 45% maturity stage and in -0.1 mpa vacuum level. Density ranged from 0.11 to 0.34 g cm^{-3}. The densities obtained in our study are similar to several in the literature. Average densities in the vacuum-packed silage %30 DM in this study are lower than average densities reported by Esau *et al*., (1990). Our results was similar to trends found by Holmes (1998). Density in BOPA/PE type package silages were the highest both mature periods. The lowest density losses were observed in PA/PE type package silages. There was a significant correlation between dry matter density with harvest moisture. *(P<0.01;r =-0.583)*. Density of silages did affected by bags type. DM losses had a negative significant correlation coefficient with the bag type for both harvest moisture *(P<0.05; r=-0.302).*

Conclusion

In this study, average DM loss at PA/PE, OPP/PE/EVOH/PE, BOPA/PE bag types was 8.85, 6.08 and 10.96% for densities of 0.16, 0.20, and 0.24 g cm^{-3}, respectively.

The analysis of variance of DM loss in vacuum-packed silages showed significant difference of the mature stage, vacuum level and bag types. Dry matter densities of the vacuum-packed bag silages ranged from 0.11 to 0.34 g cm^{-3}. The lowest DM loss and the lowest standard deviation was in the OPP/PE/EVOH/PE type bag silage at all of the storage time. OPP/PE/EVOH/PE type bags are recommended for use in practice for vacuum-packed bag silage.

REFERENCES

ASAE Standarts. 2002. Moisture measurement-forages. ASAE S358.2. Standarts, 565. St. Joseph,MI.

Büyüktosun N, Tan F. 2015. Effects on Forage Quality and Use in Vacuummed Silage Bags of different Polyethylene Materials. *Journal of Tekırdag Agricultural Faculty*. Vol.12 (3):62-67.

Cai Y., Ohmomo S, Ogawa M, Kumai S. 1997. Effect of NaCl-tolerant lactic acid bacteria and NaCl on the fermentation characteristics and aerobic stability of silage. *Journal of Applied Microbiology*. 83, 307-313.

Esau CA, St. Laurent AM, Misner GC. 1990. Clean-out device for silage compactor. Applied Engineering in Agriculture. 6(1):29-31.

Holmes B.J. 1998. Choosing forage storage facilities. In Dairy Feeding Systems Management, Components and Nutrients, 38-59, NRAES-116, Ithaca, NY: NRAES.

Holmes BJ. Muck RE. 2002. Silage density in bunker and bag silos. Accessed at: http://www. uwex. edu /ces/forage/wfc/proceedings2002/silage_density.htm.

Kennedy SJ., 1987. Alternative silage making. *Irish Grassland and Animal Production Association Journal*. 21:146.

Köhler B, Diepolder M, Ostertag J, Thurner S, Spiekers H., 2013. Dry matter losses of grass, lucerne and maize silages in bunker silos. *Agricultural and Food Science*, 22:145-150.

Muck RE, Holmes BJ. 2001. Density and losses in pressed bag silos. ASABE paper number: 01-1091.

Rony DD, Dupuis G, Pelletier G., 1984. Digestibility by sheep and performance of steers fed silages stored in tower silos and silo press bags. *Can. J. Anim. Sci*., 64(2):357-364.

Savoie P, Amyot A, Theriault R., 2006. Effect of density, cover, depth and storage time on dry matter loss of corn silage ASABE paper no:061048.

Toruk F, Kayısoglu B. 2008. Effect of applied vacuum of silage package machine on silage quality. *Journal of Agricultural Machinery Science*, Vol:4 (4**)**, 355-360, İzmir.

Wallentine MV. 1993. Silage storage systems in the arid west. *In Silage Production from Seed to Animal*, 124-133, NRAES-67, Ithaca, NY: NRAES.

****