HUNGARIAN AGRICULTURAL ENGINEERING
N° 34/2018 30-34
Published online: http://hae-journals.org/
HU ISSN 0864-7410 (Print) / HU ISSN 2415-9751(Online)
DOI: 10.17676/HAE.2018.34.30
Research Letter
Received: 2017.10.17.; Accepted: 2018.09.23.

PERIODICAL OF THE COMITTEE OF AGRICULTURAL AND BIOSYSTEM ENGINEERING OF
THE HUNGARIAN ACADEMY OF SCIENCES
and
SZENT ISTVÁN UNIVERSITY
Faculty of Mechanical Engineering

IMPROVING THE WEARING PROPERTIES ON BIOGAS PLANT SHREDDING MA-CHINE

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Abstract

Using biomass for energeticis the most environment friendly and the best ecological solution to generate biogas. In agricultural environment generally use the primer biomass, and second-ary (from livestock) biomass is used for generate biogas. The technology mostly use primer materials, like parts of plants, rest of seeds. These materials make stable the biogas plant. The ingredients are nearly the same across the product year. Input materials for fermentation are quite variable. These materials influence the method for preparation. Solid materials as inputs for fermentors necessary to make smaller parts by shredding machine.

Keywords

economy, energy production, biogas, modern technology

Introduction

The NHSZ Biogas Tatabanya Ltd. biogas plant use mixed materials to generate biogas. The most important part of the technology is the preparation of the fiber (mainly corn) for shred-ding [1]. In our tests we used BHS Biorinder RBG 08 type solid material mincing machine was applied. The machine shredding prorepties wasn't compliance at case of different input solid material. The fermentors vane usually was covered long fiber materials. That event make bad effect for mixing and fermentation process. On other hand the parts of the machine had intense changing period, because of the intensive wearing effect. Figure 1 shows the BHS Biogrinder RBG 08.

The technical suggestions were at the following areas [2]:

- hard metal technology to avoid the intensive wearing
- the mentioned wearing parts hardened by hard metal technology
- operational test for long distance application ability
- economical analysis for return of investment.

The structure of the grinding unit

The biomass grinding is made by turning hammers [3]. One machine is able to get 12 hammers. The material flow is supported by standing part, it is working like a standing knife. The turning parts are demonstrated in Figure 2 and 3.

Figure 1. The BHS Biogrinder RBG 08 parts

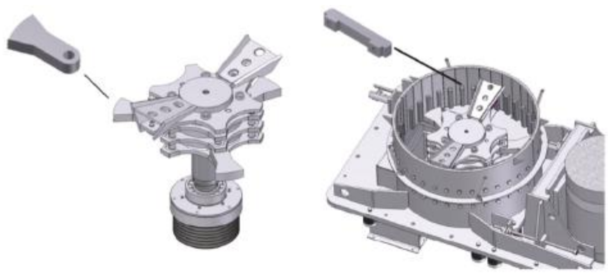

Figure 2. The BHS Biogrinder RBG 08 machine turning and fix parts

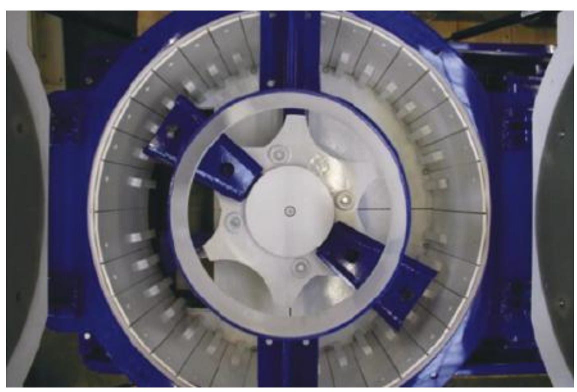

Figure 3. The turning and fix parts view from top

The Wearing

The parts of the machine what are touched by moving materials are wearing caused by the friction. The input materials used for biogas generating creating wearing, and the hammers form is changing. Different input materials have different effect on the wearing. The most intensive wearing made by sand dust from manure. The rest of soil moved by the animals' leg.

This effect is typical on animal farms. The tested plant is a real source of danger, because the sand rate of the manure is high. Because of the wearing fix part and moving hammer have bigger distance, the shredding efficiency get worse. Figure 4 and 5 show the difference be-tween the original and used hammer.

Figure 4. Distance between fix part and hammer, original (operational photo)

Figure 5. Distance with used hammer (operational photo)

Figure 6. Manure from straw, before and after

Based on institute (Institut für Landtechnik und Tierhaltung, Weihenstephan, Freising) meas-urement we mentioned that the structure of manure from straw not changed using hammered shredding (Figure 6). This type of machine is not applicable for this type of materials.

Figure 7. Worn hammer

Figure 7, 8 and 9 show the worn hammer and its implemented and stand-alone forms. The form changing is too big for normal usage.

Figure 8. Used hammer

Figure 9. Unmounted used hammer

Improvement by hard metal welding

Technologies for improving wear resistance:

- hard metal scattering is electric scattering
- hot metal spraying
- pottery reading
- application of porous ceramic
- abrasion resistant plastic spray
- manufacture of abrasion-resistant inserts, lining and parts
- spark welding

– heat treatment
– surface treatment

At the Szent István University Mechanical Engineering Faculty we made hard metal welding.

For testing 3 hammer was prepared 3 different welding:

1) The (-) signed hammer, the suture was parallel with the axle.
2) The (/) signed hammer the suture was at 45° by the axle, at the same distance
3) The (X) signed hammer the suture was at 45° by the axle but the oppsite direction as / signed hammers. Sutures are at the same distance.

Scattering is good for improve working period, and the optimal material usage also important. Figure 10 shows the hammers.

Table 1. shows the technical parameters of the welding technology

Figure 10. Hard metal welded hammers

Table 1. The technical parameters of the welding technology

Sign	Standard	Chemical (%)	Current
502	DIN 8555: E 10-GF-60 GR	C: 5,50 Mn: 1,50 Cr: 40,0 Other: 2	= +160 A

Wearing test

The shredder was used at normal working conditions (Figure 11). After 600 working hours the wearing was too big for normal conditions. we checked the parts by eyes. We diagnosed that there is no dangerous anomaly (broken parts, deformation, other structural injury).

Figure 11. After 600 working hour, with hard metal welding

Figure 12, 13 and 14 show the hammers. As the pictures shows there is no injury on the hammers. The signs are for identification.

Figure 12. Hammers, side view

Figure 13. Hammers, top view

Figure 14. Hammers, button view

2. Material and Method

We use 3D scanning to measure the wearing size. The 3D scanner is a ZScanner 700 machine.

The 3D scanning method [4,5]:

- define joints, surface net
- elementary body unit calculation
- surface units summary

The scan results of the worn hammer are shown in Figure 15.

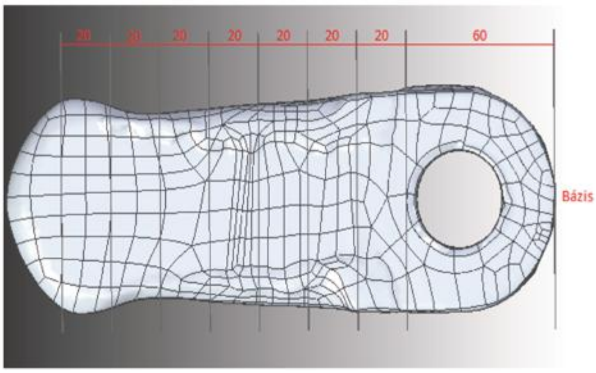

Figure 15. Scanned worn hammer

3. Results

Table 2 shows the results for (/) hammer. This has the minimal size changing 83,5% based on the original size. The most worn hammer is the (-) signed.

Table 2. Size changing

Size (long) [mm]		
(x) worn	**(-) worn**	**(/) worn**
219	218	222
(x) new	**(-) new**	**(/) new**
267	266	266
rate		
(x)	**(-)**	**(/)**
0,820	0,820	0,835

Table 3 shows the width changing by the different parts.

We calculated the wear by the weight of the hammers. Weight is calculated from the volume of the original and worn hammers (Table 4).

Table 4. Volume and weight changing

	Volume [mm^3] new		
	(X)	**(-)**	**(/)**
	1056435	1066941	1047621
	Volume [mm^3] weared		
	(X) weared	**(-) weared**	**(/) weared**
	357603	333335	358062
Volume rate:	0,338	0,312	0,342

	Weight [g] weared		
	(x) weared	**(-)weared**	**(/)weared**
	2750	2550	2760
	Weight [g] new		
	(x)	**(-)**	**(/)**
	8124,08	8162,06	8075,23
Weight rate:	0,338	0,312	0,342

	(X)	(-)	(/)
	1056435	1066941	1047621
	Volume [mm^3] weared		
	(X) weared	**(-) weared**	**(/) weared**
	357603	333335	358062
Volume rate:	0,338	0,312	0,342

	Weight [g] weared		
	(x) weared	**(-)weared**	**(/)weared**
	2750	2550	2760
	Weight [g] new		
	(x)	**(-)**	**(/)**
	8124,08	8162,06	8075,23
Weight rate:	0,338	0,312	0,342

Conclusion

Based on the operational tests we diagnose that the hard metal welded hammers make more effective and economical operating. Optimal solution based on suture is the (/) signed hammer. Based on our measurement we recommend that structure. Our test shows that the button part is worn more. Because of this, we recommend the whole button part should be covered by hard metal.

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