



## BIOGAS PRODUCTION POTENTIAL IN ANAEROBIC DIGESTION OF SWINE MANURE WITH DIFFERENT SOLID FRACTION CONCENTRATIONS AND TEMPERATURES

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**Abstract:** This work aimed to evaluate the biogas production potential of swine manure (SM) under different temperatures through the use of experimental biodigesters (EB), investigating the physical, chemical and microbiological parameters of the process. The experiment consisted of three treatments a) with solid fraction separation (WSSF), b) without solid fraction separation (W-SSF) and c) solid fraction only (OSF). The assays were performed in triplicate and submitted to room temperature (RT) (13.36 to 23.71° C) and to controlled temperature (30.00°C), during 28 days. The average biogas production in the EB was 390.41 ml (WSSF), 390.53 ml (W-SSF) and 400.53 ml (OSF), at RT and 393.00 ml (WSSF), 393.00 ml (W-SSF) and 390.67 ml (OSF) at 30.00°C. The results showed that significant differences occurred in the biogas production due to the different treatments and temperatures. The highest average reduction of parameters as a function of treatment and temperature was 53.22% for total solids in WSSF (30°C), 10.73% for nitrogen in W-SSF (RT), 27.50% for phosphorus in the WSSF (TA), 63.55% for the COD in the W-SSF (TA), 99,10% for the total coliforms in the W-SSF (TA) and 99.59% for the thermotolerant coliforms in the WSSF (30°C).

**Keywords:** Swine farming. Biodigesters. pH. Temperature. Methane gas. Coliforms.

### 1 Introduction

Swine farming is an important activity in the agribusiness (VIANCELLI et al., 2013). In the meat market it is responsible for the creation of jobs, acting as an income-stabilizing factor for thousands of families (FERNANDES et al., 2014; SUZUKI et al., 2014).

The world consumption of pork is in expansion, which leads to an increase in the demand for the production of this type of protein (CARVALHO; SOUZA; SOTO, 2015). As a consequence of this process, swine

farming has incorporated technological innovations in their production systems which have allowed the rearing of herds in the intensive form in increasingly smaller areas (URBINATI; DUDA; OLIVEIRA, 2013). However, this scenario has led to an increase in the generation of swine manure (SM) which has an important polluting potential, and may cause environmental and sanitary imbalances if inappropriately managed (DUDA ;OLIVEIRA, 2011; MENG et. al., 2013).

One of the alternatives for the adequate treatment of the SM in the first

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stages is the anaerobic biodigestion (HALMEMAN et al., 2014; SANTOS; OLIVEIRA, 2011). It is a process decomposition of organic matter by different groups of microorganisms in the absence of free molecular oxygen which results in two main sub-products: biogas and biofertilizer (KLEINSTEUBER 2014; OLIVEIRA; DUDA; FERNANDES, 2014; SILVA et al., 2013; SUÁREZ et al, 2014). The first may be used as biofuel in the generation of electric and / thermal power and the second in the organic fertilization of the soil, thereby generating value-added products (GALBIATTI et al., 2010; RODRIGUEZ-VERDE et al., 2014).

The quantity of SM which is produced daily by the swine farming activity constitutes a source of biomass which may be used in a sustainable way for the generation of renewable energy with an important contribution for the agribusiness chains (KONRAD et. al., 2014; LIMA; MIRANDA, 2014; MÖNCH-TEGEDER; LEMMER; OECHSNER, 2014; XIE et al., 2011).

The anaerobic digestion process culminated with the development of biodigesters (AQUINO et al., 2014). There are several models of biodigesters, however the most common ones are the Indian, Chinese and Canadian, and each one has a peculiarity, but all with the same objective: they all create an environment with the absence of oxygen which promote the growth of the anaerobic bacteria, which will decompose the organic matter and produce biogas, and, in addition, these systems have structures to store the gas (SOUZA; MIRANDA, 2012; XAVIER; LUCAS JÚNIOR, 2010).

The treatment of the SM having as a protagonist the use of biodigesters has important environmental and health impacts (SUNADA et al., 2012). Their use contributes to the decrease of the surface water, soil and groundwater pollution, caused by the inadequate disposal of SM and also reduces the emission of greenhouse gases, mainly the methane gas (GARFÍ et al., 2012; MANNING; HADRICHS, 2015). Furthermore, it reduces the sources of proliferation of disease-causing vectors (TIETZ; SOARES; SANTOS, 2013).

Taking into account this bioenergy and biofertilizer production potential and the mitigation of environmental and health

impacts obtained by the treatment of MS by anaerobic biodigestion, it is important to carry out research that seeks to improve this technology by exploring the possibilities of greater gas production, as well as the improvement of the positive impacts on health and the environment.

This work aimed to evaluate the biogas production potential of SM containing different solid fraction concentrations subjected to anaerobic digestion in experimental biodigesters under ambient temperatures as well as 30°C, investigating the physical, chemical and microbiological parameters of the process.

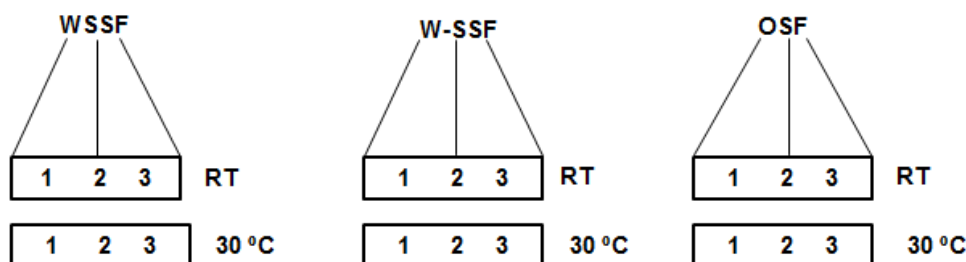
## 2 Methodology

This work was carried out in the experimental area of the Federal Institute of Education, Science and Technology of São Paulo, Brazil, São Roque *campus* (IFSP-SRQ), in the period from 07 May - 03 June 2015, totaling 28 days. 18 experimental biodigesters (EB) were built having as biomass the SM which was acquired from a technified swine farm located in the municipality of Ibiúna- SP, Brazil.

Six treatments were carried out using a completely randomized design, in a 6X3X2 factorial scheme, with three replications each, being three of them submitted to room temperature (13,36°C – 23,71° C) (RT) and the others to 30 °C which were maintained in a digital oven of bacterial cultivation.

The EB which remained under RT and at 30°C (mesophilic temperature range) were filled as follows, a) with separation of the solid fraction (WSSF), b) without separation of the solid fraction (W-SSF) and c) only the solid fraction (OSF) (Figure 1). The swine manure used was composed of excrements, urine, sawing, water lost in the wash of the stalls and in the drinker of animals. In the experimental group the OSF solid materials decanted in the box were used. The WSSF group encompassed the supernatant liquid. And the W-SSF included the mixture of solid sedimentary with the supernatant. In order to obtain the SM WSSF, a 6,35 mm sieve was used, attached to a decanting box, referred to the solid gross fraction and the SM which passed through the sieve constituted the W-SSF.

Figure 1 – Schematic representation of the experiment

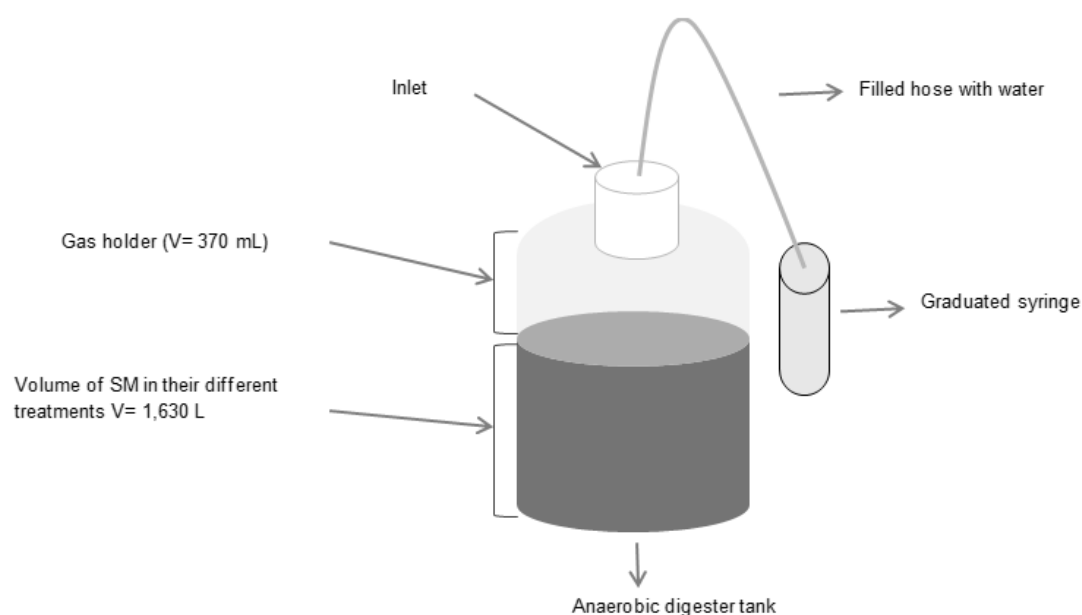


The EB were constructed from polyethylene bottles with a maximum volume of two liters and single supply (batch model). In these bottles was inserted a pipe with 60 mm of length and 20mm diameter and polyvinyl chloride caps. A flexible plastic hose with 1.20 m length and 2 mm of diameter was

connected at one side at this pipe and at the other one at a graduated plastic syringe with maximum volume of 60 mL (Figure 2).

Each EB received the volume of 1.630 L of SM in their different treatments and replications.

Figure 2 - Scheme of the experimental biodigester used in the work



For the assessment of the biogas production in the different EB, the entire interior of the hose was filled with water. The water displacement and accumulation in the syringe indicates the biogas production in each EB (Figure 2).

The biogas production in the EB was measured daily throughout the 28-day period. For the EB which were maintained in RT, it was checked at pre-determined times during the 28 days in which the experiment was carried out.

For the determination of the pH, Total Solids (TS), nitrogen, phosphorus, Chemical Oxygen Demand (COD), Total Coliforms (TC) and Thermotolerant Coliforms (TtC) a

sample of 500 mL was collected in each EB at day zero and at the 28<sup>th</sup> day and stored under refrigeration. These parameters have been analyzed according to the methodologies described in Table 1.

To compare the results from the different groups (WSSF, W-SSF and OSF) for each temperature (RT and 30°C) and the experimental moments (days 0 and 28) the General Linear Model was used, with multiple comparisons with the Tukey's test (ZAR, 1999). The level of significance adopted in all the analysis was 0.05, and the statistical package used was the SPSS for Windows 20.0.

Table 1 - Parameters and methods used in this work

Parameters	Method
pH	Reaction in calcium chloride method (Raij et al. 2001)
Total Solids (TS)	APHA (2000)
Nitrogen and the phosphorus	Semi-micro Kjeldahl method (AOAC 1990)
Chemical Oxygen Demand (COD)	APHA (2000)
Total Coliforms (TC) and Thermotolerant Coliforms (TtC)	Vanderzant technique, (VANDERZANT; SPLITTSTOESSER, 1992); SILVA; JUNQUEIRA V. C. A.; SIVEIRA (2007)

### 3 Results and discussion

In Table 2 are presented the results concerning the average biogas production in the three treatments submitted to different temperatures during the 28 days in which the experiment was carried out.

The average RT during the period of the experiment was 18.54°C, with a minimum of 13.36°C and maximum of 23.71°C, which indicated favorable conditions for the growth of psychrophile microorganisms (KASHYAP; DADHICH; SHARMA, 2003; MASSÉ et al., 2008). It was observed that in the SFS EB maintained in this temperature condition, the

average biogas production was 10 mL higher than that produced in the WSSF and W-SSF EB, and W-SSF EB and the average biogas production in the WSSF and W-SSF EB are equal.

As for the EBs submitted to 30°C, in which was established an optimal growth condition of mesophilic microorganisms, the average of the EB WSSF presented an increase on biogas production when compared to the EBs of the W-SSF and OSF treatments, which practically had the same performance (Table 2).

Table 2- Average biogas production (mL) in the six treatments with experimental biodigesters submitted to different temperatures during 28 days

Treatment	Room temperature (13.36 – 23.71° C)	Temperature at 30.00°C
WSSF	390.41	393.00
W-SSF	390.53	389.75
OSF	400.53	390.67

WSSF- with separation of the solid fraction; W-SSF- without separation of the solid fraction; OSF- only the solid fraction.

However significant differences ( $p < 0.05$ ) in the average biogas production between the EB WSSF and OSF as well as between OSF and W-SSF in RT were detected. The comparison between the EBs submitted to 30°C showed no significant differences in the average biogas production ( $p < 0.05$ ). Miranda et al. (2012) and Orrico Júnior, Orrico and Lucas Junior (2009a), also working with anaerobic biodigestion of SM, have obtained a biogas production with higher average values. However it must be taken into account that in the present study was not carried out the previous microbial

biostabilization with activated iodine or other types of pre-treatments, as researched by Athanasoulia, Melidis and Aivasidis (2012) and Zhang et al. (2010), which can improve quality of the biomass, leading to the optimization of the process and an increase of the microbial activity, culminating in an greater biogas production. In future works, it is possible that with the previous establishment of an active anaerobic microbial flora, longer hydraulic detention time and agitation of the substrate, a greater biogas production produced by the same biomass forms originated from the SM

(WSSF, W-SSF and OSF) will happen. These alternatives may influence the general dynamics of the process of organic matter degradation by anaerobic routes (MOTTET et al., 2010).

In Table 3 are presented the pH behavior in the six treatments with EB submitted to RT and to 30°C.

**Table 3- Average pH in the six treatments with experimental biodigesters**

Treatment	Room temperature (13.36°C – 23.71° C)		Temperature at 30.00°C	
	Day 0	Day 28	Day 0	Day 28
WSSF	8.04	7.26	8.04	7.44
W-SSF	7.12	5.81	7.12	6.86
OSF	7.26	5.34	7.26	5.45

WSSF- with separation of the solid fraction; W-SSF- without separation of the solid fraction; OSF- only solid fraction.

At day zero with EB maintained at RT, the pH values oscillated around neutral values for the W-SSF and OSF treatment and around alkaline values for WSSF treatment; pH ranges that provides microorganisms growth (Table 3). On the 28<sup>th</sup> day, there was a change of values, with the prevalence of acid pH in the EB W-SSF and OSF and neutrality in the EB WSSF (Table 3). Such results showed the influence of the SM in its different forms on the microbial flora's dynamics, initially with affinity for pH values between neutrality and alkalinity, and at the end, having predominantly acidophilic microorganisms. It is worth pointed out that these average pH values are within the minimum and maximum variation ranges for the growth of the majority of the anaerobic microorganisms, which is between 4.0 and 9.0 (PEREIRA et al., 2009). It is evidenced, in this way that the alkalinity or the acidity is due to the interaction between the community of microorganisms and the substrate (HORIUCHI et al, 2002).

The EB submitted to 30°C present practically the same results that the EB maintained at RT, at day zero, , with neutral values in the EB W-SSF and OSF and alkaline values in the EB WSSF (Table 3). On the 28<sup>th</sup> day the pH have changed only in the EB OSF becoming acid, while the others W-SSF and WSSF continued to having a neutral pH. These results indicated that the temperature influenced these parameters and the established microbial flora that presents an optimum growth in pH in the neutrality range (that is greater metabolic activity). The pH reduction in both EB submitted to RT as well as to 30°C may be

explained by the formation of acid compounds such as the volatile fatty acids (AQUINO; CHERNICHARO, 2005).

The statistical analysis of the pH at the different EB , at day zero and 28<sup>th</sup>, and RT and 30°C, showed that there was significant difference ( $p < 0.05$ ) at day zero for the treatments: WSSF (RT) and OSF (RT); WSSF (RT) and W-SSF (RT); WSSF (30°C) and OSF (30°C); WSSF (30°C) and W-SSF (30°C); OSF (30°C) and W-SSF (30°C). The comparison between the days 0 and 28 showed that there were significant differences in all the treatments submitted to the two temperatures.

The average TS values in the six treatments with experimental biodigesters submitted to RT and to 30°C on days zero and 28<sup>th</sup> are represented in Table 4.

It was observed that a greater reduction of TS (43.54%) occurred in the EB WSSF, maintained at RT. In the EB W-SSF, there was little consumption of organic matter, a reduction of 17.21%. For the EB with OSF, there was an increase of TS.

The results of the TS in the EB maintained at 30°C were similar to those of the EB submitted to RT, with a reduction of 53.22% of TS in the EB WSSF. In the EB with W-SSF, there was a lower reduction of 6.62%. As for the EB OSF, the difference between the values on day zero and 28<sup>th</sup> demonstrated lower performance compared to other treatments (table 4).

Those results indicated that the temperature did not influence the TS values. However, both the WSSF treatments presented significant reductions in the percentage of TS, which were superior to

those obtained by Vivan et al. (2010) that have treated SM combining anaerobic reactors with stabilization ponds. The EB W-SSF did not achieve significant reductions in both temperatures; however this can be explained by the fact that this substrate without separation has a greater load of

solids if compared to the WSSF substrate, taking more time for the degradation of this fraction of organic matter. This demonstrates that a greater hydraulic detention time or the quantity of the solid fraction may optimize the decomposition process (ORRICO JÚNIOR; ORRICO; LUCAS JUNIOR, 2009b).

**Table 4- Average values of total solids (TS) (%) in the six treatments with experimental biodigesters**

Treatment	Room temperature (13.36°C – 23.71° C)		Temperature at 30.00°C	
	Day 0	Day 28	Day 0	Day 28
WSSF	0.62	0.35	0.62	0.29
W-SSF	1.51	1.25	1.51	1.41
OSF	15.92	18.66	15.92	15.81

WSSF- with separation of the solid fraction; W-SSF- without separation of the solid fraction; OSF- only solid fraction.

The total solids parameter at the different EB, day zero and 28<sup>th</sup>, RT and at 30°C, presented significant difference ( $p < 0.05$ ) at day 0 for the treatments: WSSF (RT) and OSF (RT); OSF (RT) and W-SSF (RT); WSSF (30°C) and OSF (30°C); OSF (30°C) and W-SSF (30°C). The comparisons

between the days 0 and 28 showed significant differences in the treatment OSF submitted to RT.

In table 5 are presented the average results of nitrogen (TKN) and phosphorus in the six treatments with EB submitted to RT and to 30°C on days zero and 28<sup>th</sup>.

**Table 5- Average results of nitrogen (N) and phosphorus (P) expressed in mg/L in the six treatments (Treat) with anaerobic experimental biodigesters**

Treat	Room temperature (13.36°C – 23.71° C)				Temperature at 30.00°C			
	N		P		N		P	
	Day 0	Day 28	Day 0	Day 28	Day 0	Day 28	Day 0	Day 28
WSSF	716.80	692.53	6978.15	5058.51	716.80	703.73	6978.15	6499.81
WSSF	1495.20	1334.67	6364.22	7050.97	1495.20	1512.00	6364.22	7008.29
OSF	1580.78	209.24	29886.76	15736.54	1580.78	220.41	29886.76	16445.40

WSSF- with separation of the solid fraction; W-SSF- without separation of the solid fraction; OSF- only solid fraction

The average nitrogen results in the EB WSSF submitted to RT on day zero were 52.05 and 54.65%, inferior to the W-SSF and OSF respectively (Table 5). This fact may be explained due to the lower concentration of organic matter in the EB-WSSF. This result assumes an environmental importance in the treatment of the SM in its initial stages. The retention of gross organic matter and nitrogen in the static screen allows these

wastes to be treated with the use of other systems, for example, aerobic ponds, as investigated by Araújo et al. (2012). On the 28<sup>th</sup> day, the reduction of nitrogen in the EB WSSF and WSSF was small: 3.38 and 10.73%, respectively, indicating that the anaerobic biodigestion was not very efficient in the nitrogen removal. However in the EB OSF the reduction of this element was of 86.76%. Ramires and Oliveira (2014) using a



UASB reactor in the treatment of wastewater obtained a total reduction of 69% of the nitrogen load.

In relation to the phosphorus, the values on day zero in the EB WSSF and W-SSF were similar; indicating that the different forms of separation to which the SM was submitted did not contribute to reduce this chemical element. However, the EB submitted to the OSF treatment presented high phosphorus reduction values when compared to the other treatments: 76.65% and of 78.71% superior to the WSSF and W-SSF, respectively. On the 28<sup>th</sup> day, there was a reduction of 47.35% in the EB OSF and of 27.50% in the EB WSSF; however, in the EB W-SSF there was an increase of phosphorus in 9.73%. Campos et al. (2006) in a laboratorial experiment with anaerobic reactors fed with SM also obtained variations in the average concentrations of phosphorus between the beginning and the end the experiment.

The results of nitrogen in the EB maintained at 30°C had smaller reductions when compared to the EB submitted to RT, 86.1% for the EB OSF, 1.8% for the EB WSSF and an increase of 1.1% in the EB W-SSF, probably due to the formation of nitrogen compounds by the microorganisms, such as nitrate and ammonia and to the adherence of these elements to the cytoplasm of the cells of the bacteria which are present in the formed iodine (SOUZA, 2012). Vivan et al. (2010) in an investigation with anaerobic biodigestion using swine

manure also obtained an increase of the ammonium nitrogen.

For the phosphorus, the removal on the 28<sup>th</sup> day, in the EB OSF was of 44.97% and in the EB WSSF was of 6.85%, values inferior to those obtained in these same treatments submitted to RT, evidencing that the temperature of 30°C negatively influenced the removal of this element. In the EB: W-SSF, as occurred in the EB at RT, there was an increase of 9.19%.

The nitrogen at the different EB, day zero and 28<sup>th</sup>, at RT and 30°C, presented significant difference ( $p < 0.05$ ) at day 0 for the treatments: WSSF (RT) and OSF (RT); WSSF (RT) and W-SSF (RT); OSF (RT) and W-SSF (RT); WSSF (30°C) and OSF (30°C); WSSF (30°C) and W-SSF (30°C); OSF (30°C) and W-SSF (30°C). The comparison between the days 0 and 28 showed significant differences only for the OSF treatment in both temperatures.

The phosphorus at the different EB, day zero and 28<sup>th</sup>, RT and at 30°C, presented significant difference ( $p < 0.05$ ) at day 0 for the treatments: WSSF (RT) and OSF (RT); OSF (RT) and W-SSF (RT); WSSF (30°C) and OSF (30°C); OSF (30°C) and W-SSF (30°C). The comparison between the days 0 and 28 showed significant differences in the OSF treatment submitted to both temperatures.

In table 6 are presented the average COD results in the four treatments with EB submitted to RT and to 30°C on days zero and 28<sup>th</sup>.

**Table 6- Average results of chemical oxygen demand (COD) (mg/L) in the four treatments (Treat) with experimental biodigesters submitted to room temperature and to 30° C on days zero and 28<sup>th</sup>**

Treat	Room temperature (13.00 to 23.71°C)		Temperature at 30.00°C	
	Day 0	Day 28	Day 0	Day 28
WSSF	5.675,00	4.333,33	5.675,00	3.200,00
W-SSF	38.187,50	13.916,67	38.187,50	18.733,33

WSSF- with separation of the solid fraction; W-SSF- without separation of the solid fraction.

It was observed that in the EB WSSF, both at RT and at 30°C, the COD was significantly lower on day zero, when compared to the EB W-SSF (Table 6). Such result reinforces the importance of separating the gross solid fraction. The COD reduction efficiency in the anaerobic biodigestion stage, was of 23.64% in the EB WSSF and 63.55% in the EB W-SSF, respectively on the 28<sup>th</sup>

day at RT. Although the reduction of COD have been higher in BE W-SSF, the values obtained in BE WSSF are environmentally more favorable, because its potential of impact is smaller. Duda and Oliveira (2009a) with SM wastewater treatment in batched reactors obtained a COD reduction from 52 to 86%. Rodrigues et al. (2010), in a work with swine farming wastewater using a

decanting system and a UASB reactor, obtained a total COD removal of 93% in 282 days of experiment. These studies confirm the perspective that a longer hydraulic detention time and the combination with other systems, could lead to greater effluent treatment efficiency.

In the EB submitted to 30°C, the COD reduction was of 43.61% in the EB WSSF, a better result than that found when this EB was maintained at RT, specifically indicating, that the temperature may contributes to reduce COD. The COD

reduction for the EB W-SSF was of 50.94%, also lower than the EB W-SSF at RT. It is relevant to observe that the COD reduction by the anaerobic biodigestion process is linked to the formation of biogas that in turns is formed from the removal of the equivalent electrons which are the components that cause the COD (AQUINO et al., 2007).

In Table 7, are presented the results obtained in relation to the analysis of the TC and TtC in the six EB maintained at RT and at 30°C on days zero and 28<sup>th</sup>.

**Table 7 – Average results of Total Coliforms (TC) and Thermotolerant Coliforms (TtC) (UFC<sup>1</sup>/mL) in the six treatments (Treat) with experimental biodigesters**

Treat	Room temperature (13.36 to 23.71° C)				Temperature at 30.00°C			
	TC		TtC		TC		TtC	
	Day 0	Day 28	Day 0	Day 28	Day 0	Day 28	Day 0	Day 28
WSSF	240	12.66	240	2.76	240	3.60	240	0.98
W-SSF	240	2.16	240	1.64	240	3.50	240	1.83
OSF	240	2.46	240	1.36	240	3.13	240	1.86

1-Colony Forming Units, WSSF-with separation of the solid fraction; W-SSF- without separation of the solid fraction; OSF- only solid fraction.

In the six EB submitted to the two temperatures, the values of TC and TtC, on day zero were elevated and equal to 240 UFC/mL. However, on the 28<sup>th</sup> day, the anaerobic biodigestion showed to be efficient in the reduction of TC and TtC (Table 7), with significant statistical difference ( $p < 0.001$ ) when compared results at day zero to the 28<sup>th</sup> in all the EB. In the EB maintained at RT the average removal of TC and TtC was of 97.6% and 99.2% respectively, with the best result for TC in the W-SSF treatment and for TtC in the EB with OSF (Table 7). In the EB submitted to 30°C, the average removal of TC and TtC was of 98.6% and 99.4% respectively, with the best result for TC in the EB with the OSF treatment and for TtC in the EB WSSF (Table 7). Duda and Oliveira (2009b) in a research with batched reactors fed with SM have obtained reduction values of 98.88% of TC and of 96.87% of TtC, similar results to those found in the present work.

This elevated capacity of reduce the TtC and TC present in the SM due to the wide temperature variation is of great

importance for the environment and health, and elects the anaerobic biodigestion as one of the protagonists in the satisfactory treatment of DS, and opens for the possibility of generation of sub-products of added value and with the capacity of mitigating impacts to the environment and to public health (ORRICO JUNIOR et al., 2012).

In relation to the statistical analysis for the TC parameter between the different EB, day zero and 28<sup>th</sup>, at RT and at 30°C, there was no difference for the treatments. For the TtC there was a difference ( $p < 0.05$ ) for the WSSF and W-SSF treatment submitted to a temperature of 30°C. The comparison between the days 0 and 28<sup>th</sup> showed that there were significant differences in all the treatments submitted to the two temperatures.

#### 4 Conclusions

The different ways of preparing swine manure and the temperatures at which this manure was subjected to anaerobic digestion



significantly influenced the biogas production in the experimental biodigesters, as well as the total solids, nitrogen and phosphorus removal efficiency and the pH value. The experimental group OSF subjected to ambient temperature and the WSSF subjected to 30°C obtained better performance in the production of biogas. Anaerobic digestion was also able to

significantly reduce the total and thermotolerant coliforms and COD, showing the importance of this process from the point of view of health and environment, which allows the safe use of the effluent. To improve the process it is suggested to stabilize and agitate the substrate in order to facilitate the degradation of the organic matter and optimize the biogas production.

### 5 Potencial de produção de biogás na digestão anaeróbia de dejetos suínos com diferentes concentrações de fração sólida e temperaturas

**Resumo:** Este trabalho teve como objetivo avaliar o potencial de produção de biogás dos dejetos suínos (DS) sob diferentes temperaturas através do uso de biodigestores experimentais (BE), investigando-se os parâmetros físico-químicos e microbiológicos do processo. O experimento foi constituído de três tratamentos: a) com separação da fração sólida (CSFS), b) sem separação da fração sólida (SSFS) e c) somente fração sólida (SFS). Os ensaios foram realizados em triplicatas e submetidos à temperatura ambiente (13,36 a 23,71°C) (TA) e à temperatura controlada (30°C), durante 28 dias. A produção média de biogás nos BE foi de 390,41 ml (CSFS), 390,53 ml (SSFS) e 400,53 ml (SFS), em TA e 393,00 ml (CSFS), 393,00 ml (SSFS) e 390,67 ml (SFS) a 30°C. Os resultados mostraram que ocorreram diferenças significativas na produção de biogás devido aos diferentes tratamentos e temperaturas. A maior redução média dos parâmetros em função do tratamento e da temperatura foi de 53,22 % para os sólidos totais no CSFS (30°C), 10,73% para o nitrogênio no SSFS (TA), 27,50% para o fósforo no CSFS (TA), de 63,55% para a DQO no SSFS (TA), de 99,1% para os coliformes totais no SSFS (TA) e de 99,59% para os coliformes termotolerantes no CSFS (30°C).

**Palavras-chave:** Suinocultura. Biodigestor. pH. Temperatura. Gás metano. Coliformes.

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## **7 Acknowledgements**

To the National Council for Scientific and Technological Development (CNPq) for the financial support provided to the project.