REVIEWER 1

We thank you very much for your useful evaluation. Below are responses to your comments.

Comment: Most of the literature is adequately referred to postulate the hypothesis, however the studies conducted under psychrophilic temperature conditions should be added to provide better understanding to the readers.

Answer: Studies regarding psychrophilic conditions are incorporated as"Lu et al. (2011) developed a microbial electrolysis cells (MECs) that could be operated at 9˚C by using *Geobacter psychrophilus* as dominating population and achieved hydrogen yield of $0.62 m^3 H_2 m^{-3} d^{-1}$. Heidrich et al. (2013) further modified MECs to a pilot-scale MEC and achieved bio-hydrogen production of $0.015\ LH_2 L^{-1} d^{-1}$ at 25˚C. On the other end, under mesophilic and thermophilic conditions, there is no need of such sophisticated technology and a better bio-hydrogen yield can be achieved by simple reactors or by lab scale batch experiments. The temperature shift from mesophilic to thermophilic conditions can change the rate of hydrogen production during anaerobic digestion (Li and Liu, 2012;Saripan and Reungsang, 2014)"

Comment: Page 12831-32, the discussion about hydrogen production with time focused on the quantity of hydrogen produced in term of volume (mL), which is not suitable for readers. So it is better to represent in term of percentage of total hydrogen production observed for specific waste under specific conditions. It can improve the representation of results and develop better understanding.

Answer: The discussion is revise as "During 0-24 hours of incubation, bio-hydrogen increased with increase in temperature for food waste, i.e. 115 mL of bio-hydrogen was produced at 37°C that increased 76.09 % and 152.17% at 46°C and 55°C, respectively. During next 24 hours of incubation, bio-hydrogen production reduced with the increase in temperature, i.e. 114.5 ml bio-hydrogen was produced at 37°C and 30.78% and 91.22% reduction was observed at 46°C and 55°C, respectively. Even after reduction in bio-hydrogen production during 24-48 hours of incubation, the cumulative bio-hydrogen production increased with an increase in temperature from food waste. It revealed the fact that first 24 hours are important for bio-hydrogen production from food waste under thermophilic temperatures and next 24 are important for production under mesophilic temperature, which is in agreement with findings of Shin et al (2004). Although noodle waste also produced more bio-hydrogen at elevated temperature, but the time effect was opposite to that observed for food waste. The bio-hydrogen production in noodle waste during 0-24 hours was 350mL at 37°C that was 5.4% and 10.81% decreased at 46°C and 55°C, respectively. But in next 24-72 hours, 178.57% and 357.14% increase at 46°C at 55°C, respectively.

So far rice waste was concerned; it has a negative impact of temperature on bio-hydrogen production. The bio-hydrogen production in rice waste during 24-48h was 131 mL, 114.5 mL and 98 mL, which was 65.65% , 75.11% and 87.76% reduced during 48-72h under 37°C, 46°C and 55°C, respectively. The reduction in bio-hydrogen production for rice waste was in agreement with previous findings (Fang et al., 2006)."

Comment: Page12833, line 6-9, How the decrease in COD removal efficiency was observed with an increase in temperature?

Answer: The bio-hydrogen yield was calculated by dividing the bio-hydrogen production with remove quantity of COD. If the increase in yield is higher than bio-hydrogen production than it means that the dividend is small. It only happened when the rate of increase in hydrogen production was higher than rate of COD removal. The discussion is revised as "When the yield measuring scale was shifted from $VS_{removed}$ to $COD_{removed}$, the results represent quite different picture of temperature impact. The increase in temperature from 37°C to 55°C increased 42.41% bio-hydrogen yield calculated on $COD_{removed}$ basis for food waste whereas the increase due to same increase in bio-hydrogen production due to temperature increase was 23.37%. Such difference in yield and production increment represented decrease in COD removal efficiency at elevated temperature for food waste"

Comment: Page 12832, line 21-22 need revision

Answer: Revised as "The bio-hydrogen yield calculated on the basis of VS_{fed} lay in the range achieved by Lin et al. (2013b) and temperature impact on yield was same as observed for P"

Comment: Page 12833, line 7, need grammatical revision

Answer: Revised as "When the yield measuring scale was shifted from $VS_{removed}$ to $COD_{removed}$, the results represent quite different picture of temperature impact"

Comment: Page 12833, line 27, reconsider the duration mentioned 28-72 or 24-72

Answer: Revised as "24-72"

Comment: Page 12835, line 20-21 need grammatical revision

Answer: Revised as "The higher concentration of VFA can also be used as an indicator for higher production of bio-hydrogen production as observed by Dong et al. (2009)."

REVIEWER 2

We would like to thank **Anonymous Referee** #2 for the timely comments on the manuscript. Below are responses to your comments.

Comment: Such studies can compare hydrogen production potential of tested waste but change in methodology raised some questions over such comparisons. So, the authors are well aware of this issue and designed the study to provide better comparison of food waste with rice waste as well as with newly focused noodle waste. The introduction part needs to address this issue and by citing the previous work, introduction part will clearly address this gap. The introduction part needs to address this issue and by citing the previous work, introduction part will clearly address this gap. Comparing the yield obtained in this study with previous work (in term of a table) will also be a good addition in this paper

Answer: The introduction part is updated to highlight this issue as "Keeping the same temperature but changing the initial pH from 7 to 8, the bio-hydrogen yield was changed from 64.48 mL/VS to 55 ml/VS under no pH control conditions (Lin et al., 2013b;Nathao et al., 2013). The same yield was increased to 70 mL/VS when pH was manually controlled for food waste under thermophilic conditions, which represents the impact of pH management (Shin et al., 2004)."

Table 3 is also added to compare the yields observed in some other similar studies

Comment: In abstract, line 8-9 need to be check, there are some typing mistakes regarding waste type and temperature condition mentioned

Answer: Thanks for indicating this mistake at our end, which was overlooked and rectified as "The maximum hydrogen yields of 82.47 mL/VS, 131.38 mL/COD, and 44.90 mL/glucose were obtained from thermophilic food waste, thermophilic noodle waste and mesophilic rice waste, respectively". Relevant corrections were also made in rest of manuscript.

Comment: Line 22-24, please explain the better understand term

Answer: Revised as "The statistical modelling returned good results with high values of coefficient of determination (R^2) for each waste type and 3-D response surface plots developed by using models developed. These plots developing better understanding regarding the impact of temperature and incubation time on bio-hydrogen production trend, glucose consumption during incubation and Volatile fatty acids production."

Comment: Introduction part, page 12825, line 5-6, 12-13 need revision for better representation

Answer: Revised as ". It has multiple advantages like 30-50 % reduction in waste volume as well as production of valuable by products such as methane and hydrogen (Lin et al., 2011)."

And "Several studies represent increase in bio-hydrogen production from food waste due to addition of buffers and minerals"

Comment In results and discussion part, page 12833, line 6-9 is a long sentence and may confuse the reader, so it is better to split them in two or more sentences.

Answer: Revised as "The increase in temperature from 37°C to 55°C increased 42.41% bio-hydrogen yield calculated on $COD_{removed}$ basis for food waste. The increase in bio-hydrogen production due to same increase in temperature from 37°C to 55°C was 23.37%."

Comment: Page 12833 line 20, delete "a" before daily.

Answer: Deleted

Comment: Page 12834 line 1, delete "was" and line 24 also need revision.

Answer: Deleted and revised as ". During 48-72h, rate of utilization remained same as previous one but rank was slightly changed as FW>RW>NW. With an increase in temperature, during 24-72h, the rate of glucose utilization decreased for food waste but increased for noodle waste and for rice waste."

Table 3. Comparison of Bio-hydrogen yield

Feed stock	Inoculum	Yield	Initial pH	Optimum pH	pH Management	Temperature (°C)	References
Food waste	Sludge	64.48 mL H_2/ VS_{fed}	7	4.8-6.4	Not controlled	37	(Lin et al., 2013b)
Food waste	Sludge	250 ml H_2 /$VS_{removed}$	6.5	6.5-5.2	Not controlled	26	(Tawfik et al., 2011)
Food waste	Kitchen wastewater	148 ± 42 ml H_2/$COD_{removed}$	5±03	5±0.3	Manually Controlled	40	(Tawfik and El-Qelish, 2014)
Food waste	Sludge	70 mL H_2/VS	5.5	5.5	Manually Controlled	55	(Shin et al., 2004)
Rice waste	Sludge	71mL H_2/VS	7	7	Not controlled	37	(Okamoto et al., 2000)
Rice waste	Sludge	134 mL H_2/VS	5.5	5.5	Manually Controlled	37	(Dong et al., 2009)
Food waste	Sludge	55 mL H_2/VS	7	6	Not controlled	55	(Nathao et al., 2013)
Rice waste	Sludge	346 mL H_2/g carbohydrates	4.5	4.5	Manually Controlled	37	(Fang et al., 2006)
Noodle Industry wastewater	Anaerobic microflora	1.47 mol H_2/mol hexose	4.5-8.5	5.2	Controlled	35	(Mizuno O, 2000)
Food waste	Sludge	44.83 mL H_2/g COD	8	8-4.5	Not Controlled	55	(Wongthanate and Chinnacotpong, 2015)
OFMSW	Sludge	205 ml H_2/g VS added	5.5	5.5	Automatic pH controller	55	(Chu et al., 2008)
Food waste	Sludge	82.47 mL/g VS Removed	7	7-4.4	Not Controlled	55	This study
Noodle waste	Sludge	131.38 mL/g COD Removed	7	7-4.4	Not Controlled	55	This study
Rice waste	Sludge	44.90 mL/g glucose Removed	7	7-4.3	Not Controlled	37	This study

REVIEWER 3

We would like to thank **Anonymous Referee** #3 for his keen interest and valuable comments on the manuscript.

Comments: In abstract, the authors indicate the increase in hydrogen production with temperature for food waste but later on mentioned that maximum yield belongs to food waste under mesophilic temperature. Although the cumulative bio-hydrogen production and hydrogen yield are close to each other, still the reason should be given regarding this issue, though it is understood that the VS removal was higher at elevated temperature but still it should be mentioned in the abstract.

Answer: Thanks you very much for indicating this important issue. In fact it was a typing mistake at our end. The maximum hydrogen yield for food waste was observed under thermophilic conditions. It is now incorporated in abstract as “The maximum hydrogen yields of 82.47 mL/VS, 131.38 mL/COD, and 44.90 mL/glucose were obtained from thermophilic food waste, thermophilic noodle waste and mesophilic rice waste, respectively”. So far VS removal is concerned; we are agreed with your point of view that VS removal efficiency increased with an increase in temperature. The increase in bio-hydrogen yield on VS basis was not so high (2.86%) against the cumulative bio-hydrogen production (23.41%), which is in agreement with said statement. This issue is also incorporated as “The increase in P with temperature for food waste was 23.41% whereas the yield increased by 2.86% only that indicated the efficient removal of VS at higher temperature.”

Comment: The main objective of the paper is to study the impact of temperature along with absence of pH management practice, but in introduction this aspect was not carefully discussed.

Answer: Setting up specific initial values doesn’t include in pH management practice but after incubation starts, the pH could be maintained by different ways which can increase the cost. In current research, no method was opted to control the pH during incubation and this methodology is termed as “absence of pH management practice”. Now the introduction is improved as by incorporating “The pH can be controlled by automatic pH controllers, addition of nutrients and buffers, manual monitoring and control (Yasin et al., 2011;Zhu et al., 2008;Kim et al., 2004). But all these methods increase the cost of operation. Along with cost, maintaining pH at specific point is not suitable especially when mix culture is used as the response of different microbial stream could be different to same pH level. So, by co-digestion, the pH of the anaerobic digestion process can be improved and it can be further adjusted to a desired initial value by adding HCl or NaOH, which can reduce the cost of operation (Fang et al., 2006)."

Comment: I think addition of few more examples especially regarding psychrophilic conditions would be good to address this issue.

Answer: It is incorporated as "Lu et al. (2011) developed a microbial electrolysis cells (MECs) that could be operated at 9˚C by using *Geobacter psychrophilus* as dominating population and achieved hydrogen yield of $0.62 m^3 H_2 m^{-3} d^{-1}$. Heidrich et al. (2013) further modified MECs to a pilot-scale MEC and achieved bio-hydrogen production of $0.015\ LH_2 L^{-1} d^{-1}$ at 25˚C."

Comment: In methodology part, P 12827 L 25-26 need some clarification regarding the way opted to manage 10%TS with addition of extra water.

Answer: This is an important aspect as most of the studies focused on the quantities of feed stock and sludge, which can cause confusion that the study was conducted in liquid phase or solid phase. In order to keep the things simple, percentage representation was used. For better understanding, the said part of methodology is revised as "In order to achieve 10% initial TS concentration, water was added along with feedstock and sewerage sludge in the digesters. The feedstock and sewerage sludge were added in equal proportion. "

Comment: Figures 3, 5, 7 need to be redrawn as the values mentioned on axis are in small in size that they are unable to read. Increasing the font size can help to address this problem. The 3-D surface plots need support of contours so that the variation trend is understood in better way. So, I strongly recommend incorporating contours in same figure or adding another figure as composite. At the same time the discussion part should be updated in the light of contour plots for improving the quality of manuscript.

Answer: Figures are upgraded and separate contour plots were also added. The discussion is updated in the light of 2-D contours as for cumulative bio-hydrogen production "The three dimensional (3-D) response surfaces and two dimensional (2-D) contours were developed within the experimental range for each waste type by taking bio-hydrogen production as response by using above mentioned equations. The 3-D and 2-D curves of the calculated response showed the interaction of incubation time and temperature in figure 3a-c. For food waste, it is clear that the gas production increases with time and temperature from 115 mL at the starting end to 354 mL at the extreme modeled conditions. During 0-24 hours of incubation, bio-hydrogen increased with increase in temperature for food waste, i.e. 115 mL of bio-hydrogen was produced at 37°C that increased 76.09 % and 152.17% at 46°C and 55°C, respectively. During next 24 hours of incubation, bio-hydrogen production reduced with the increase in temperature, i.e. 114.5 ml bio-hydrogen was produced at 37°C and 30.78% and 91.22% reduction was observed at 46°C and 55°C, respectively. Even after reduction in bio-hydrogen production during 24-48 hours of incubation, the cumulative bio-hydrogen production increased with an increase in temperature from food waste. The impact of temperature and time can be bettered viewed in 2-D contour (Fig. 3a), which shows that the increase in temperature increase bio-hydrogen production more at 24h as compared to 72h of incubation. It also revealed the fact that first 24 hours are important for bio-hydrogen production from food waste under thermophilic temperatures and next 24 hours are important for production under mesophilic temperature, which is in agreement with findings of Shin et al (2004). Although noodle waste also produced more bio-hydrogen at elevated temperature, but the time effect was opposite to that observed for food waste. The bio-hydrogen production in noodle waste during 0-24 hours was 350mL at 37°C that was 5.4% and 10.81% decreased at 46°C and 55°C, respectively. But in next 24-72 hours, 178.57% and 357.14% increase at 46°C at 55°C, respectively.

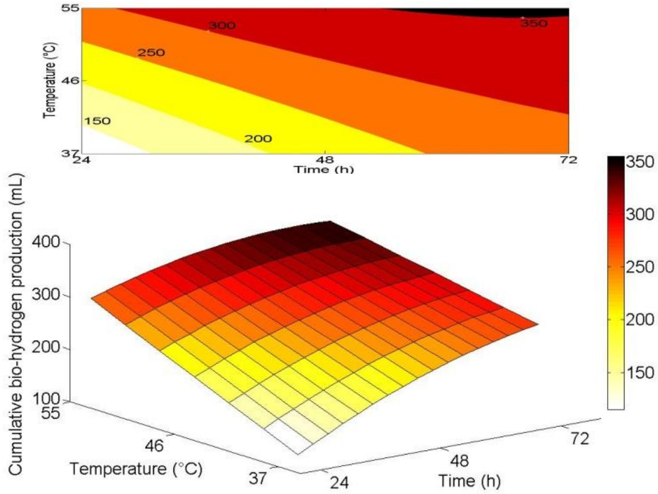
So far rice waste was concerned; it has a negative impact of temperature on bio-hydrogen production. The bio-hydrogen production in rice waste during 24-48h was 131 mL, 114.5 mL and 98 mL, which was 65.65% , 75.11% and 87.76% reduced during 48-72h under 37°C, 46°C and 55°C, respectively. The reduction in bio-hydrogen production for rice waste was in agreement with previous findings (Fang et al., 2006). The 2-D contours in fig. 3b and 3c differentiate the impact temperature with time on bio-hydrogen production for noodle waste and rice waste as the contour patterns are quite opposite to each other. ”

For glucose consumption as “During 48-72h, rate of utilization remained same as previous one but rank was slightly changed as FW>RW>NW. With an increase in temperature, during 24-72h, the rate of glucose utilization decreased for food waste but increased for noodle waste and for rice waste. The contours represented better understanding for glucose consumption and the contour varied in different manners for each waste type as shown in figure 5."

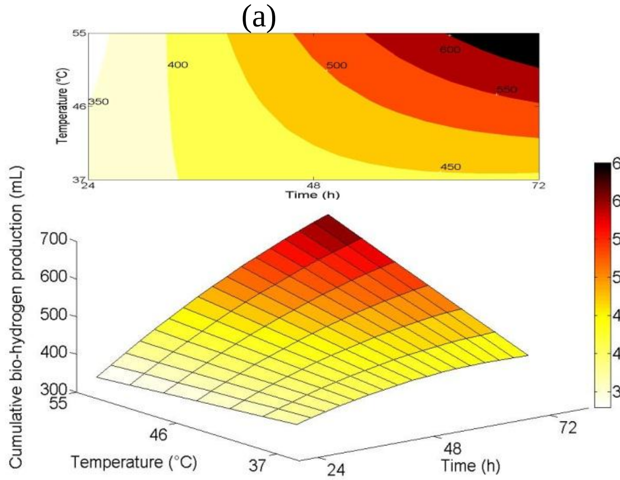
For VFA production "The 3-D contours for food waste and noodle waste seems almost same but the contour lines for both varied in different manner. Although the production of VFA increased with time and temperature in all reactors but the intensity of change is different for each waste type as observed in figure 7."

Comment: The conclusion part should include study objective that will develop better understanding regarding the findings. Also it should strongly emphasis on opting thermophilic conditions for hydrogen production from food and noodle waste

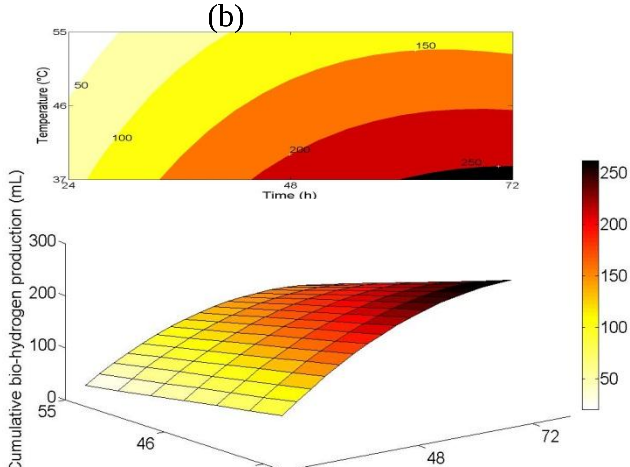
Answer: It is revised as "Food waste and its two major derivatives, i.e. noodle waste and rice waste, were co-digested with sewerage sludge to produce bio-hydrogen with an initial pH of 7 under mesophilic and thermophilic conditions. The pH was not controlled throughout the incubation. The most effective VS removal was observed in noodle waste reactor that produced the highest experimental cumulative bio-hydrogen of 656.5 mL under thermophilic conditions. The food waste possessed the highest bio-hydrogen yield calculated on the basis of $VS_{removed}$ that represents an efficient conversion of VS into bio-hydrogen. The increase in temperature within the studied range increased the bio-hydrogen production in food waste and noodle waste reactors. The rice waste reactor represented the negative impact of increasing temperature on bio-hydrogen and VFA production. The thermophilic conditions should be preferred for bio-hydrogen production as most of the time food waste is used as feed stock."



(a)

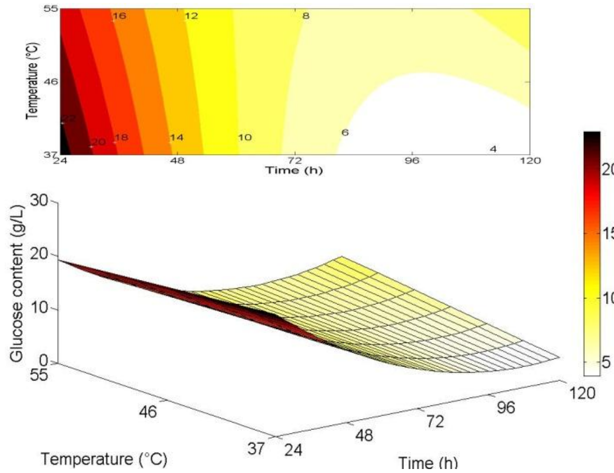


(b)

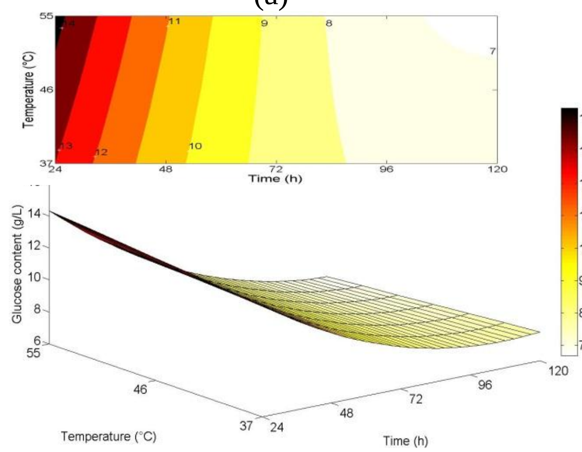


(c)

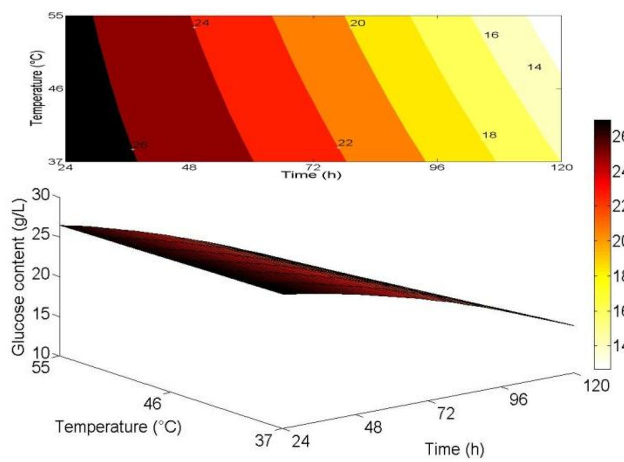
Figure 3. Three dimensional response plots for bio-hydrogen production (a) Food waste, (b) noodle waste, (c) Rice waste



(a)

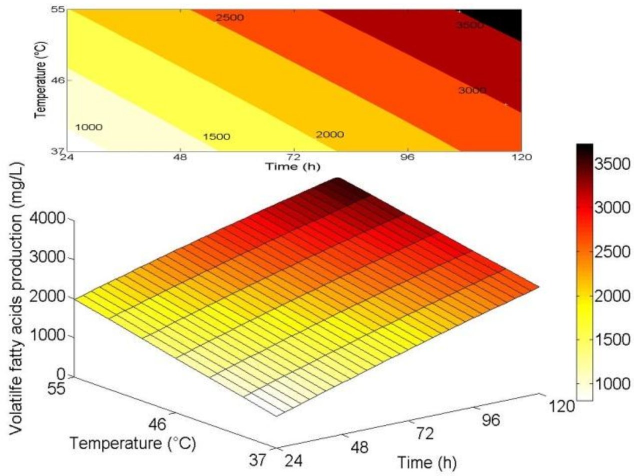


(b)

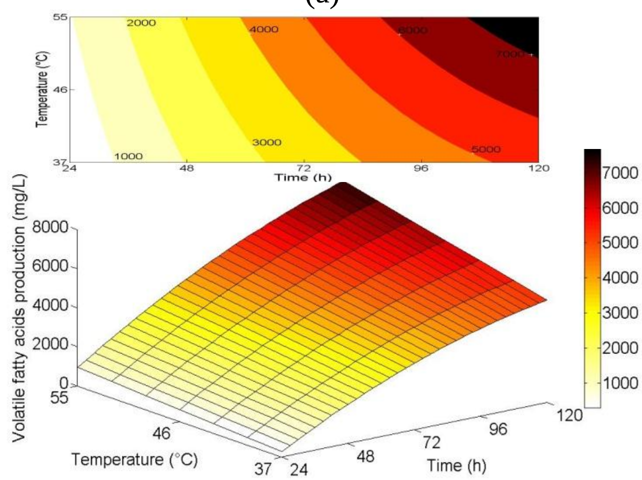


(c)

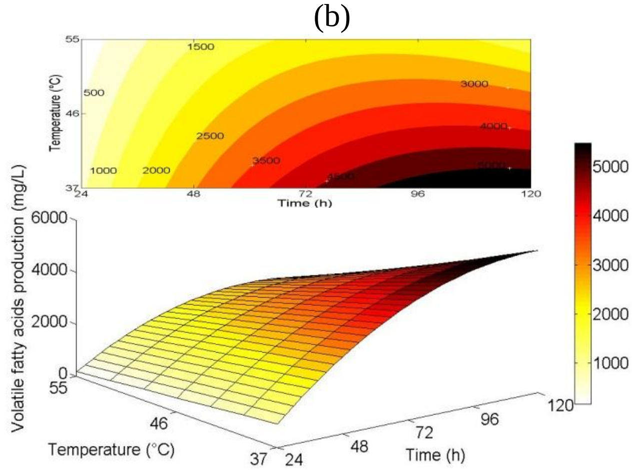
Figure 5. Three dimensional response plots for glucose consumption a) Food waste, (b) Noodle waste, (c) Rice waste



(a)



(b)



(c)

Figure 7. Three dimensional response plots for VFA production a) Food waste, (b) Noodle waste, (c) Rice waste

REVIEWER 4

We thank **Anonymous Referee** #4 for the constructive comments and suggestions. Please find our response below;

Comments: Introduction part needs little improvement; like, all aspects of Clostridium should be described at one place together instead of discussing at two different places (Page 12825 & 12826).

Answer: Combined as "The cost of production can be reduced by adding sewage sludge as a source of *Clostridium* mix culture (Fang et al., 2006). Nutritional deficiency in food waste was also balanced by adding sewage sludge and made food waste suitable for bio-hydrogen production (Shin et al., 2004). It means that integrated waste management can be done at wastewater treatment plant by co-digestion of sewage sludge and food waste. Although sewerage sludge is a good source of *Clostridium* mix culture, but at the same time, it contains hydrogen consumers. Heat treatment is mostly opted to deactivate hydrogen consumers. The traditional method of placing sewage sludge in boiling water is now no longer in practice and replaced by microwave heating that provide more uniform heating as compared to the boiling water method (Luo et al., 2010;Wang et al., 2011;Duangmanee et al., 2007). The temperature and time for heat treatment varied from 75°C to 121°C for 15 minutes to 2 hours, but 100°C for 15 minutes was mostly reported (Li and Fang, 2007;Fang et al., 2006). "

Comment: There should be some information about the hydrogen production under hyper thermophilic conditions.

Answer: incorporated as "Whereas, hyper-thermophilic provide better pathogenic destruction but it may also decrease the bio-hydrogen production (Sahlström, 2003;Yokoyama et al., 2007)."

Comment: The study emphasis on hydrogen production without pH control practice so introduction part should have some discussion about selecting such practice

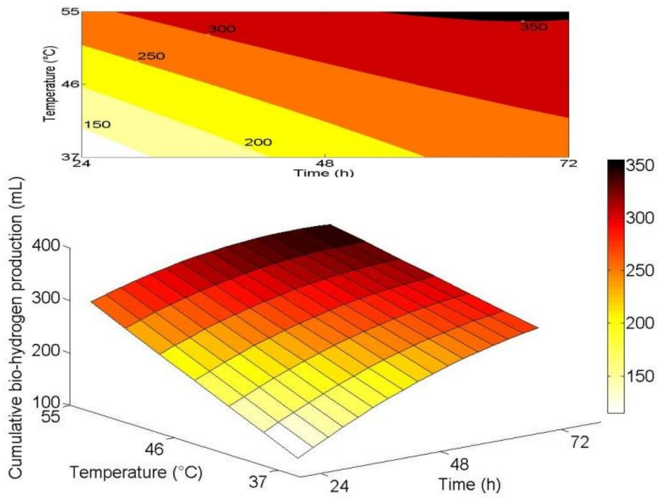
Answer: Introduction is updated as "The pH can be controlled by automatic pH controllers, addition of nutrients and buffers, manual monitoring and control (Yasin et al., 2011;Zhu et al., 2008;Kim et al., 2004). But all these methods increased the cost of operation. Along with cost, maintaining pH at specific point is not suitable especially when mix culture is used as the response of different microbial stream could be different to same pH level. So, by co-digestion, the pH of the anaerobic digestion process can be improved and it can be further adjusted to a desired initial value by adding HCl or NaOH. After adjusting the desired initial pH under co-digested conditions, the bio-hydrogen production can be achieved under no pH control conditions, which can reduce the cost of operation (Fang et al., 2006).”

Comment: Figure 5 represents the consumption of glucose with time and temperature. More discussion should be done on glucose consumption representing the impact of temperature on specific waste with respect to time, in the light of modeled equations developed.

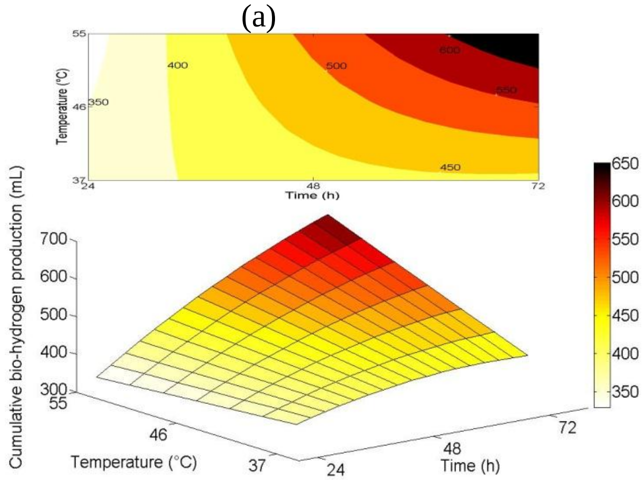
Answer: Updated as “As a whole, the glucose consumption at the end of incubation was higher at 37°C as compared to 55°C for food waste. The noodle waste and rice waste represented quite opposite picture of glucose consumption with temperature as observed for food waste at the end of incubation.”

Comment: The representation of three dimensional figures needs improvement in term of readability.

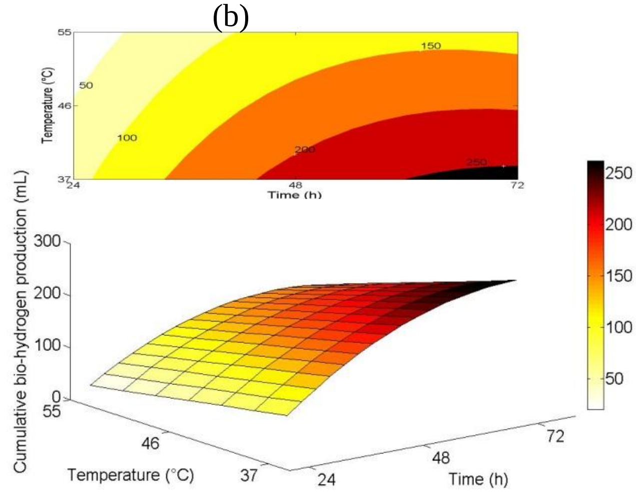
Answer: the figures were re drawn to overcome this issue. The revised figures are given below,



(a)

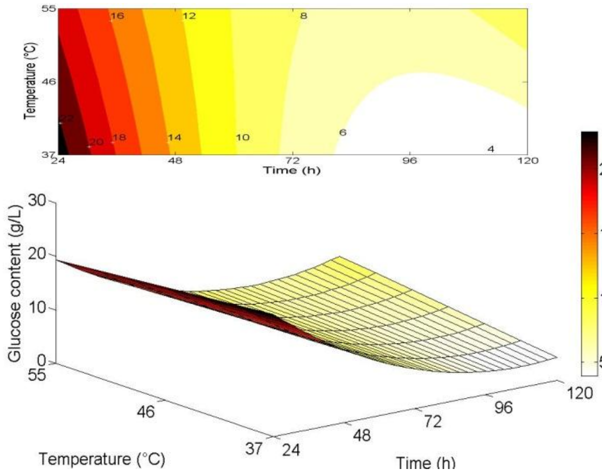


(b)

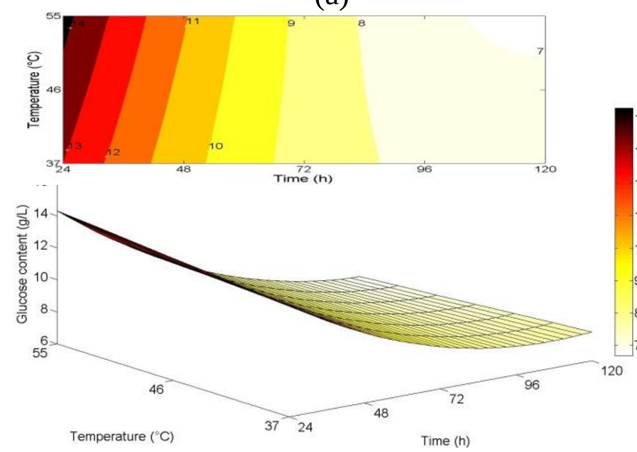


(c)

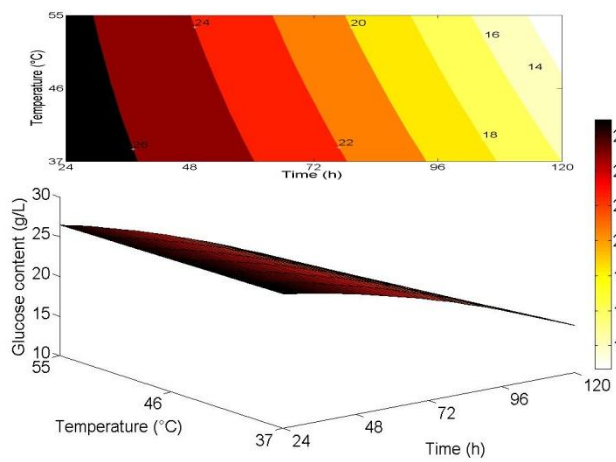
Figure 3. Three dimensional response plots for bio-hydrogen production (a) Food waste, (b) Noodle waste, (c) Rice waste



(a)

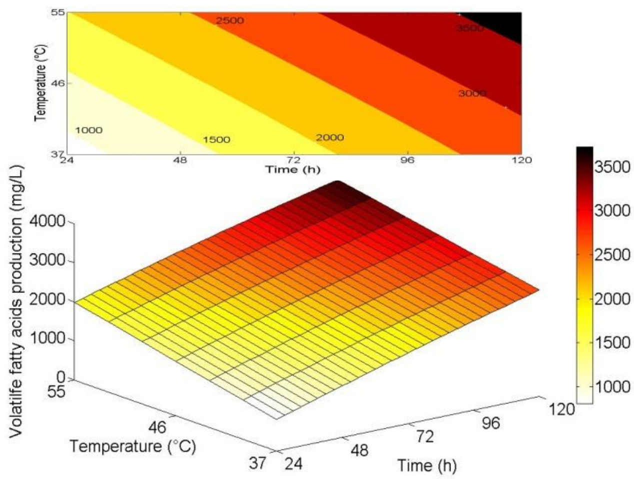


(b)

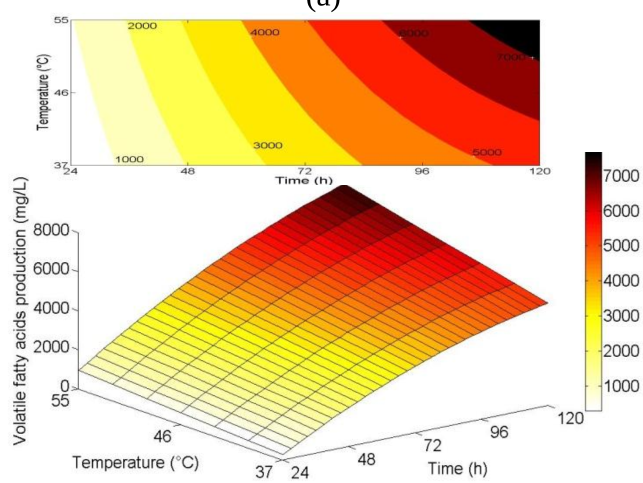


(c)

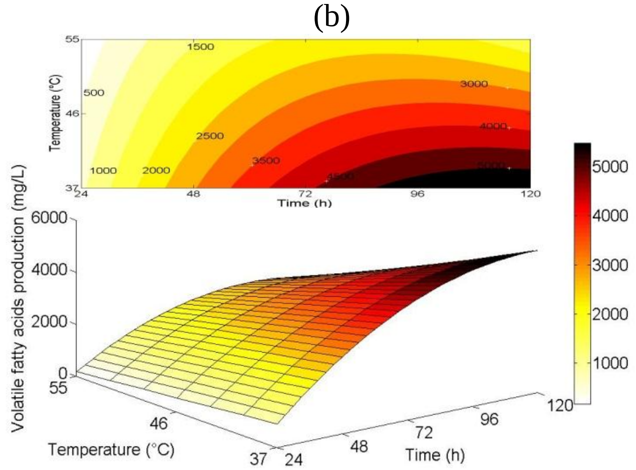
Figure 5. Three dimensional response plots for glucose consumption a) Food waste, (b) Noodle waste, (c) Rice waste



(a)



(b)



(c)

Figure 7. Three dimensional response plots for VFA production a) Food waste, (b) Noodle waste, (c) Rice waste

Comment: Page 12825 Line 2 replace “one century” with “a century”

Answer: Replaced as advised

Comment: Page 12825 Line 5 reconsider use of preposition “reduction of”

Answer: Replaced by “reduction in”

Comment: Page 12825 Line 9 Rephrase “more than 80% of food waste consists of the volatile solids

Answer: Revised as “The food waste contains more than 80% volatile solids”

Comment: Page 12826 Line 4 describe hydrogen consumers

Answer: Revised as “it contains hydrogen consumers like methanogens”

Comment: Page 12826 Line 8 add suitable preposition “temperature and time heat treatment”

Answer: Updated as “The temperature and time for heat treatment”

Comment: Page 12826 Line 23 rephrase “yields are misleading if it is calculated in term of”

Answer: Revised as “The yields are misleading if calculated in term of added or start up values of VS, COD and glucose as it seems quite impossible that the whole of added material is converted into hydrogen”

Comment: Page 12827 Line 16 “It was grounded in a meat grinder” need revision to explain “it”.

Answer: Revised as “The food waste was then grounded in a meat grinder with equal amount of water and resultant slurry was used for bio-hydrogen production”

Comment: Page 12827 Line 24 Revise “two series of experiment”

Answer: Revised as “Two series of experiments were conducted in duplicate in 550 mL digesters with working volume of 400 mL”

Comment: Page 12831 Line 25 place suitable unit to describe 79.25

Answer: It was 79.25 mL but the specific discussion is revised in term of percentage as “During 0-24 hours of incubation, bio-hydrogen increased with increase in temperature for food waste, i.e. 115 mL of bio-hydrogen was produced at 37°C that increased 76.09 % and 152.17% at 46°C and 55°C, respectively.”

Comment: Page 12831 Line 25 Replace “at” with “during”

Answer: Revised as mentioned in previous comment.

Comment: Page 12832 Line 13 Revise “it has a negative impact of temperature on bio-hydrogen production”

Answer: Revised as “temperature has a negative impact of on bio-hydrogen production.”

Comment: Page 12832 Line 21 Revise “The effect of temperature on P and yield was calculated on the basis of VSfed was same”

Answer: Revised as “The bio-hydrogen yield calculated on the basis of VS_{fed} lay in the range achieved by Lin et al. (2013b) and temperature impact on yield was same as observed for P.”

Comment: Page 12833 Line 6 “the COD removal efficiency decreased with an increase in temperature” required explanation like given for RW in previous paragraph

Answer: Revised as “The increase in temperature from 37°C to 55°C increased 42.41% bio-hydrogen yield calculated on $COD_{removed}$ basis for food waste. The increase in bio-hydrogen production due to same increase in temperature from 37°C to 55°C was 23.37%.”

Comment: Page 12833 Line 7 Place “,” after picture

Answer: The sentence was revised as “When the yield measuring scale was shifted from $VS_{removed}$ to $COD_{removed}$, the results represent quite different picture of temperature impact”

Comment: Page 12833 Line 20 delete “a” from “on a daily basis”

Answer: Deleted as “The yield was further studied on daily basis and it was observed that the highest yield of 33 mL/ $glucose_{removed}$ for 0-24h duration belonged to noodle waste under mesophilic condition.”

Comment: Page 12833 Line 20 please specify the yield

Answer: Specified as “The yield calculated on glucose basis”

Comment: Page 12835 Line 20 Revise “indicator of higher production of bio-hydrogen production as observed”

Answer: Revised as “The higher concentration of VFA can also be used as an indicator for higher production of bio-hydrogen as observed by Dong et al. (2009)”