Response to Reviewers

[Cover Letter]

Dear Editor,

We appreciate you and the reviewers for your precious time reviewing our paper and providing valuable comments. It was your valuable and insightful comments that led to possible improvements in the current version. The authors have carefully considered the comments and tried our best to address every one of them. After careful revision, we hope the manuscript will meet your high standards. The authors welcome further constructive comments if any. Below we provide point-by-point responses. All modifications to the manuscript have been reported in the tables below.

Sincerely,

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Response to Reviewer 2

Comment #	Note	Line -before	Line-after	Response
1.1	Some flaws in the wording make some sentences incomprehensible (e.g. lines 55-56	55-56	54-56	Thanks for your kind reminders. We revised the sentence. Modified to 'AcoD of MWW and CM reduces an input organic matter's chemical oxygen demand (COD) and bio-chemical oxygen demand (BOD), which it uses for energy recovery in the form of biogas [9–10, 11]."
1.2	"However" on 65-66	65	65	deleted
1.3	Line 82	81-82	80-81	Thanks for your kind reminders. We revised the sentence. Modified to "As a result, varied performance is anticipated in ZVI supported AD systems using biowaste may perform differently at varying concentrations of ZVI [24–26]."
1.4	Line 184	184	176-178	Thanks for your kind reminders. We revised the sentence. Modified to "The acidification is related to VFA production, loading rate of COD and double-bond removal. The acidification rate is an essential factor to evaluate the efficiency of digestion process [45-47]".
1.5	Line 216	216	208-209	Thanks for your kind comment. We revised the sentence. Modified to "Symbols of the BMP tests that were supplemented with various concentrations of NP-ZVI which were obtained at various MVRs."

1.6	Line 294	294	290-292	Thanks for your kind comment. We revised the sentence. Modified to "Peak values of TCOD redaction efficiency coincided with higher CH4 daily production of 0.015, 0.011, and 0.008 Nm3 CH4/kg versus 30 mg NP-ZVI/g VS at MVR-4:1, MVR-2:1, and MVR-6:1, respectively." Accumulative results were deleted and replaced with daily CH4 production.
1.7	Line 314	314	308-312	Modified to "MVR-4:1 was achieved maximum dye adsorption capability 5204, 3628, 2615, 2290, and 2016, 1845 mg/g of 30, 20,10, 50,60 mg NP-ZVI/g .VS. The strength of the catalyzed reaction and the subsequent interaction of moles of Fe3+ and Fe2+ and BH4- as a result of its particular structure may be related to stoichiometric chemistry."
	Line 336		326-327	Modified to "Zhang et al. [55] found that 1 g/L ZVI increased polysaccharide degradation by 15.8% compared to the control."
	Line 468	468	454-457	Modified to "This conclusion is in line with recent studies [47, 53, 57]. These studies observed that organic fraction waste treatment with a particular level of iron nanoparticles increased the removal efficiency of contaminants in comparison to the control test".
	lines 551- 553 what is "respectively" referring to?).	551-553		The word "respectively" is not present in the sentences!
2	Lines 144-146 are unnecessary because the	144-146		Revised accordingly.

	method of determining solids is common knowledge.			deleted
3	Line 150, the equation number is missing.	150		Revised accordingly., Modified all equations number
4	Line 199, correct for “equation 4”.	199		Revised accordingly. Modified all equations number
5	Section 2.4: the definition of MVR and how they were implemented, as well as their relevance are unclear.	Section 2.4		Thanks for your question. The synthesis of suitable nanoparticles involves a reaction that varies the mixing volume ratios of ferrous sulphate heptahydrate iron crystals (Fe2SO4.7H2O, 0.05 M) and sodium borohydride (NaBH4, 0.2 M, 50 ml). The color immediately changes from clear brownish to black when colloidal precipitate forms during the reduction reaction. Various volumes of ferrous sulphate are used, including 100 mL, 150 mL, 200 mL, 250 mL, and 500 mL. In order to observe the effect of oxidation on iron, the temperature and pH are maintained at atmospheric conditions. The relevance of varying the mixing volume ratio in the synthesis of nanoparticles lies in its ability to affect the reaction outcome. By altering the ratio of ferrous sulphate to sodium borohydride, different particle sizes, structures, and properties may result. This can influence the efficiency and effectiveness of the synthesis process and ultimately lead to the production of nanoparticles with the desired characteristics. By studying the impact of the mixing volume ratio, we can optimize

				the synthesis process to produce nanoparticles with the desired properties.
6	Line 212, completely incomprehensible, please correct.	212	201-202	Thanks for your kind reminders. We revised the sentence Modified to “The nanoparticles, which had mostly a spherical and a chain structure, were produced in a laboratory with a size of about 20–100 nm. “
7	Lines 244-245, clarify whether the reactors used were batch, if they were, it makes no sense to speak of hydraulic retention time.			Deleted “After adding the designed concentrations of NP-ZVI to the co-substrate in the batch digesters, the BMP reactors began to run and required 30 days to reach stability.”
8	Please correct spelling errors in the header of Table 2.	Table 2		corrected
9	Line 255, use mg/L and not mg/l.		249	corrected
10	Line 285, the results discussed in the following lines are not explicit in Table 3, nor can they be verified.	288-293	279-287	Modified to “Figures 3 (a-c), in comparison with the control test, the addition of test B30 enhanced SCOD concentrations by 3.9%, 43.6%, and 31.31% at day one, day six, and day fifteen, respectively. According to the Table 3, in comparison with the control test, the maximum hydrolysis (%) was achieved at MVR-4:1 for 30, 20, 10, 40 mg NP-ZVI/g VS with improvement by 86.67%, 74.89%, 74.33%, 63.45%, respectively. While 50 mg NP-ZVI/g VS achieved improvement by 65.15 at MVR-6:1. Where the SCOD concentration of the control test was 1.78, 2.5, and 0.99 g/L after one day, day six, and day 15,

				respectively, and 44.1% of hydrolysis percentage.”
11	Lines 299-300 please clarify what is “hydrolysis concentration”?	299-300	298	Modified to “hydrolysis percentage”.
12	Line 296, reconsider the use of the word “versus”.			done
13	Figure 1, axis YY, reconsider name of the axis, is it g/L substrate? What is “substrate” in this case? Or do the authors mean “reaction volume”?	Figures 1 (a-c)		MODIFIED TO ” (g/L)” Yes mean reaction volume
14	Lines 353-354, was the TCOD determined for the liquid phase only? How do the authors explain that TCOD removal is not accompanied by CH4 production?	353-354		No, methane production is related to TCOD removal. This trend could be due to the sorption of the substrate during the high COD removal, and a portion of the total COD may be utilized for H2 production at the first stage, while the methanogens stage was not completed 100% due to the test conditions. also, it was noted that created carbon layer around the some nanoparticles also a traces of hydrogen sulfide in the biogas which was analyzed in the digested samples.
15	Line 409, what is the “contaminant”?	409		TCOD
16	Figure 3, the YY axes must always have the same scale (100%, as these are percentages).			In fact, I present them with a different Y-axis level to reveal the difference between the test results and more readability.

				If this is necessary, I will work to change it according to what you see fit.
17	Line 448-449, are the amounts shown the removals or increases in removals?	448-449	441-442	In theses line reported the figure 3 (e) title These values shown in figures were the removal amount
18	Line 476, verify if the CH4 content values are correct, they do not match those in Table 4.	476	470-477	Corrected "The addition of 30 mg NP-ZVI/g VS in the digestion of OMW:CM resulted in biogas and CH4 contents in the range of 80-10.2% and 22.86-16.95%, respectively, at various MVR. Also, the addition of NP-ZVI ≤ 30 mg and different MVRs enhanced the daily production of biogas and CH4 content. The maximum biogas yield among the tests with the addition of NP-ZVI doses was 0.389 Nm^3/kg VS for the B test (30 mg NP-ZVI/g VS and an MVR-4:1) with a CH4 content of 68.34%, while the yield of biogas and the CH4 content of the control test were 0.216 Nm^3/kg VS and 55.62%, respectively."
19	Section 3.5: Consider presenting methanization efficiency results that allow the biological removal of substrates to be assessed.	Section 3.5	494-497	Presented from 494-497