**Authors’ Response to Reviewers**

**Title: Hydrogen conversion using gasification of tea factory wastes**

Dear Editor,

First of all, the authors wish to thank the Reviewers, the Associate Editors, and the Editor in Chief for their valuable and constructive comments. The author believes that the paper, in its current version has been significantly revised and hopefully improved. Following the instructions of the reviewers, the authors have addressed their comments and have revised the manuscript. The authors believe that the revised manuscript is of better quality and trust that the subsequent evaluations will be positive.

Prof. Afsin Güngör

**Reviewer Comments:** The novelty of this paper is not currently very clear, as demonstrated by the conclusion section, which only contains one statement (ln 245) which actually relates to the work carried out, and even there the evidence provided is rather tenuous. The line states that a Water Gas Shift system has an important role in H2 production, which would certainly make sense. However, my understanding is that the model applied was validated on a gasifier without a WGS and that the data in table IV relates only to the gasifier. It is therefore not clear how the model arrived at the results presented in Fig 2, whereby the WGS reaction increased the H2 produced by about 1.5 and decreased the CO production by about 2. Without any experimental data relating to how much a WGS would actually increase H2 production, how can the reader judge whether the model has done a good job in predicting the benefits of the WGS? In addressing this concern in the results and discussion, the authors should also address the balance of the conclusion - Line 248 feels like a more appropriate conclusion for the papers used as a source of experimental data (Jahay et al and Ayas and Esen) than the present work. The introduction should also be modified to emphasize what is new about the work described in this paper.

**Authors:** In this study, the potentials of converting the tea factory wastes which are harmful to the nature in case of being released to the environment by gasification are examined. In this study, mathematical modeling for a biomass gasifier has been developed. In the model, stoichiometric thermodynamic equilibrium biomass gasification model was used. Simulations of models were performed with the optimal rates which are assumed to be 100% for carbon conversion efficiency in the gasification process. The most important difference of the developed model from the studies in the literature is that the gasifier has a WGS unit and the model includes all of these (gasifier and WGS reactor). The validity of the developed model was obtained by comparing the experimental data obtained from the literature and the model results under the same conditions. After proving the validity of the developed model, the effects of biomass moisture content and A / F ratio changes on the product gas were investigated. These investigations were also confirmed by experimental data.

The model with WGS reactor was previously validated with experimental data of similar biomass gasification and in this study the model was validated with the experimental data collected from literature.

Therefore, the model predictions and the conclusion statements can be considered as reliable. The introduction part has also improved to emphasize the significance of present work as requested by the reviewer.

**Reviewer Comments:** Lines 177-183: Your modelled WGS reactor is running at 310 C (a high temperature shift), and is thus kinetically favorable but unable to proceed to complete CO conversion (as seen in results in Fig 2). A discussion about whether it would be economic in this instance to have an additional low temperature shift reaction to drive the reaction further towards H2 production would be interesting.

**Authors:**

In this study, high temperature WGS reactor was used. It is clear from the model results that using WGS reactor is important for H2 production. However, as can be seen clearly in the results in fig.2 high temperature WGS reactor co has been found to provide full conversion. This can be overcome by introducing a low temperature WGS reactor in addition to the biomass gasifier model considered in this study. This is also important in that WGS reactors need to be used as both high temperature and low temperature WGS reactors in biomass gasifiers.

As can be seen from the comparison of model results and experimental data (Table IV) the CO conversion of the model is in good agreement. The increased H2 content and decreased CO content can be reached through the water gas shift reaction (WGSR) where CO reacts with steam to produce H2 and CO2. WGS reaction is exothermic, hence at higher temperatures the reaction shifts to the reagents and reduces CO and favors H2 production.

**Reviewer Comments:** Fig 2: The layout of this figure is confusing - the mol H2/kg tea waste produced after the WGS is repeated in 3 different locations. The boxes at the top and their accompanying black arrows should just be deleted, and the tabulated data at the bottom incorporated into the block diagram to avoid data repetition.

**Authors:** Figure 2 has revised according to reviewer’s comment.

**Reviewer Comments:** Lines 208-215. All of this information should be incorporated into the Introduction around lines 68-73. Lines 221-236 discuss in detail the gasification results, but there is literally no discussion provided in the text for the WGS results. Please expand the discussion.

**Authors:** The statements in between Lines 208 and 215 has been moved to induction part and the discussion part has been expanded as recommended by the reviewer.

**Reviewer Comments:** Line 231: As I understand it, the input data used in Fig 2 was taken from Ayas and Esen, and this line states that your model data agrees with the experimental data in that paper? A more detailed comparison of their experimental results and the results from your model would be helpful.

**Authors:** Details of the experimental results has been included in the revised manuscript.

**Reviewer Comments:** Finally, the English language throughout the paper is understandable, but somewhat error-strewn. If the authors could have a native English speaker check this manuscript, it would likely greatly improve its readability.

**Authors:** As recommended by the reviewer the document has been proofread by an academic native speaker of English.

**Reviewer Comments:** I think the topic of this paper is interesting, and it may be suitable for publication after revision. In my opinion, this manuscript should be published as an original scientific paper.

**Authors:** The authors would like to thank the reviewer for positive and constructive comments.