**Response to reviewers**

**Reviewer B**

According to my previous comments, the authors added the reference to their previous work (Journal of the Taiwan Institute of Chemical Engineers 86 (2018) 73–80) and a few basic sentences comparing the results. To my opinion this is not sufficient, given the fact that the experiments were conducted at the exactly the same operating conditions and at the same experimental setup. The thorough comparison is necessary when such similar materials are used under the exactly same operating conditions. The authors should re-write the Introduction section in order to explain how they did the experiments simultaneously with the previous ones and to state that this paper is the continuation of the previous one. Also, some explanations about the reasons for different behaviors of magnesite and magnesite slag should be offered, rather than just simple statements about this. The authors should add at least one table comparing the results (such as adsorption capacity etc...) obtained for magnesite and magnesite slag.  
Therefore I think that the paper is not suitable to be published in the present form, and I recommend MAJOR REVISION. As I said in the previous Review, the authors should completely rewrite the paper and draw the adequate conclusions with clear comparison with previous work.

**Answer:**

1. The introduction has been rewritten as follows:

“Since 2000, many countries have been constantly setting records of high temperature, and the number of days with high temperature continues to increase. The degree of the global warming has more than that in the past. The global environment will be a major change, and these changes will change the life of the people in different form. Countries have begun to take measures of energy conservation and emissions reduction to slow climate change process. Carbon capture and sequestration (*CCS*) technology was proposed and considered to be one of the major solutions to mitigate greenhouse problems internationally, intending to reduce 20% emission by 20201. The methods to capture CO2 mainly include pre-combustion capture, post-combustion, oxy-combustion capture and others. The existing technology has physical absorption separation, adsorption separation, membrane separation, cryogenic distillation and absorption, emerging of oxygen-enriched combustion and chemical chain combustion technology, etc.. The reports on adsorption separation are more, due to the advantages of regeneration and convenient industrial application, while the important issues for the methods is to develop a non-polluting and efficient adsorbent2. Researchers have developed ionic liquids3, *MOFs*4, alkali metal oxide5, activated carbon6 and porous materials7 for CO2 capture, obtaining some achievements. Many new materials also appear constantly. Alkali metal and alkaline oxide, especially MgO, CaO based sorbents, are investigated mostly due to abundant sources, low cost, as well as non-toxicity8. However, MgO based adsorbents need lower regeneration temperature than CaO based types, so MgO has advantages in regenerating MgCO3 to MgO. Many investigations on MgO based adsorbents were reported, MgO/Al2O39, mesoporous MgO10, MgO-TiO211, MgO-SiO212, MgO-C13, MgO-ZrO214, and so on15-19. In addition, the cyclic CO2 removal process based on MgO type sorbents was proposed to realize the circulation.

We investigated the CO2 adsorption performance by magnesite in previous work20. Thus, we proposed if the slag could be used in CO2 capture, as it was a kind of wastes and also contained MgO, CaO, SiO2 and other alkaline oxide, which have CO2 adsorption performance. As the result, it exhibited better CO2 adsorption performance. As the continuation of the previous work, we investigated the CO2 adsorption performance of magnesite slag in the same experimental setup and the methodology of the investigation, and compared the CO2 performance with the magnesite. The obvious difference and advantage of this paper from the previous work lies that not only CO2, but also a waste are processed. Applying magnesite slag in the CO2 capture can not only reduce greenhouse gas emission, but also comprehensively utilize industrial waste residue, with advantages of abundant source, no pollution, low cost and recycling easily21. ”

2. The following paragraph was added at the end of the Section *Regeneration of the adsorbent*

“Compared the results of magnesite slag to the magnesite (Table SII), it was found that the calcined magnesite achieved CO2 adsorption capacity 1.82 mmol/g under the optimal condition of 60 oC, 0.4 Mpa, 100 mL/min flow rate. The slag got 2.12 mmol/g CO2 adsorption capacity under the condition of 80 oC, 0.4 Mpa, 150 mL/min flow rate, and reach 3.01 mmol/g when the pressure increased to 0.8 Mpa. The CO2 adsorption performance of slag was obvious superior to magnesite.”

The Table SII to compare the magnesite and slag was added in the Supplementary

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Sample* | *Calcination temperature*, oC | *Calcination time*, h | *Adsorption temperature*, oC | *Flow rate*, mL/min | *Adsorption pressure*, Mpa | *CO2 adsorption capacity*, mmol/g |
| Magnesite20 | 550 | 4 | 60 | 100 | 0.4 | 1.82 |
| Magnesite slag | 500 | 5 | 80 | 150 | 0.4 | 2.12 |
|  | 500 | 5 | 80 | 150 | 0.8 | 3.01 |

3. The comparison of XRF and BET to analyze the reasons for different behaviors of magnesite and slag was added in Section *Characterization, paragraph 1st and 5th.*

By compared the *XRF* results of magnesite and slag (Table SⅡI), it can be seen that the composition is different obviously. From the experiment results, it can be seen that CO2 adsorption performance is superior to magnesite. Thus, the utilization of MgO in slag is high, which may be due to the assistant of SiO2, Al2O3, CaO.

The *BET* surface area of magnesite is 122.8 m2/g20, higher than slag. The superior performance of slag indicated that the assistance played an important role in CO2 adsorption performance, though the *BET* surface area also could influence it.

4. The following was added in the Section *Conclusion*.

The experiments results showed that 500 oC for 5 h was enough to make magnesite slag decompose to MgO. CO2 adsorption capacity 3.01 mmol/g was achieved under the condition of 80 oC, 150 mL/min, 0.8 Mpa, and reduced to 2.18 mmol/g after 8 cycles, which was obvious superior to magnesite with 1.82 mmol/g CO2 adsorption capacity under the optimal condition of 60 oC, 0.4 Mpa, 100 mL/min flow rate.

Compared to the previous work, the slag as a waste, has better performance on CO2 capture, and the impurities could play an assistant role.