

OBTAINING GRAPHENE OXIDE FROM HIGH-RANK COLOMBIAN COAL USING LIQUID PHASE EXFOLIATION (LPE) METHOD

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Introduction

This poster describes the results obtained in the pretreatment of coal dust for the synthesis of graphene oxide (GO) via Liquid Phase Exfoliation (LPE) process [1] from a Colombian semianthracite coal (Table 1).

Table 1. Proximate analysis of Coal sample

Sample	Humidity (%)	Volatile Matter (%)	Ash (%)	Fixed Carbon (%)
Semianthracite (S.A.)	8.19	6.10	12.10	79.20

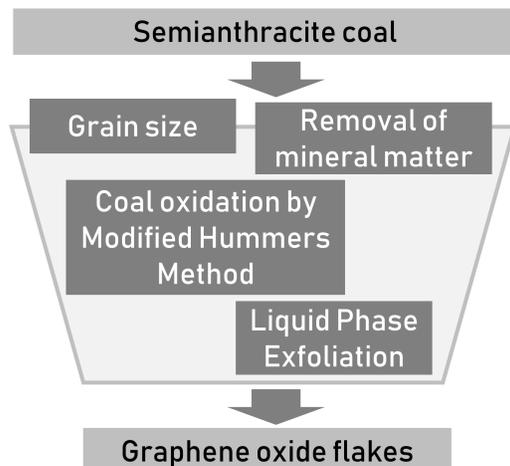


Figure 1. GO synthesis method from semianthracite coal

Experimental methods

A sample of semianthracite coal was taken as it leaves the mine. Later, sample was processed to achieve a grain size suitable for synthesis of GO products. In order to compare the yield, coal samples were pretreated with an alkaline mineral matter removal procedure.

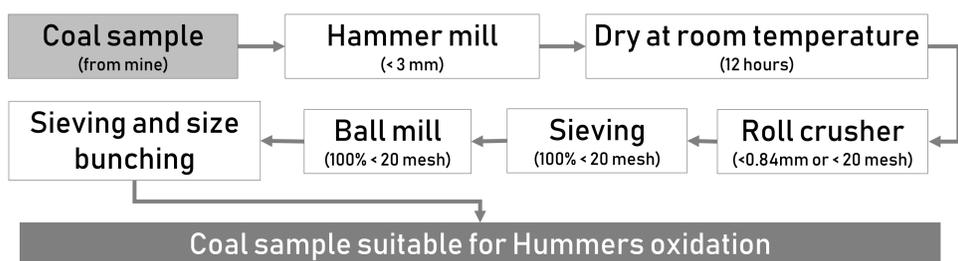


Figure 2. Diagram for obtaining of coal samples sieved with different grain size

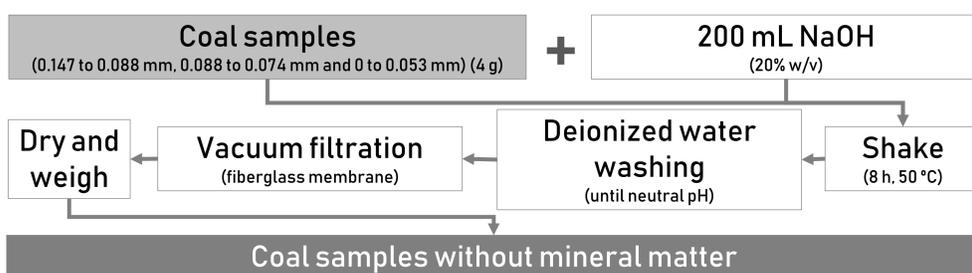


Figure 3. Alkaline mineral matter removal procedure [2]

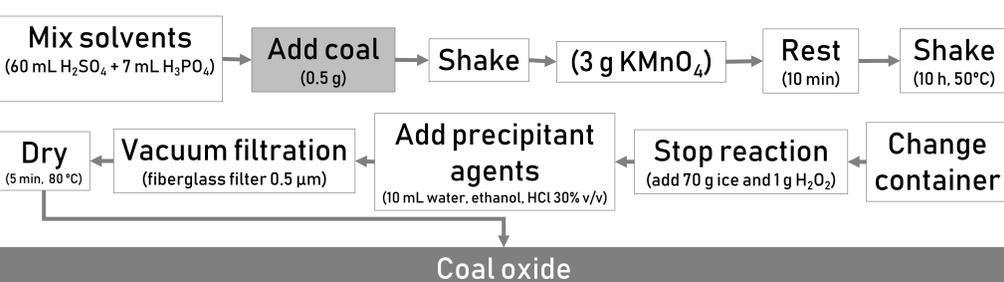


Figure 4. Modified Hummers Method for GO synthesis

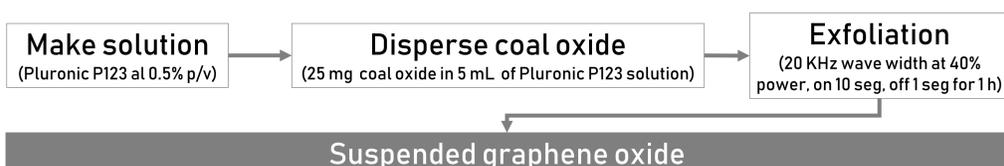


Figure 5. LPE method to obtain GO

Results

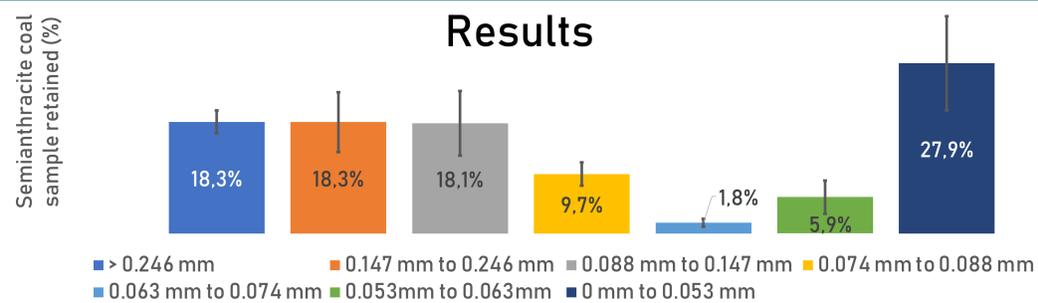


Figure 6. Grain Size distribution of semianthracite coal sample sieved (n=18) [3]

Table 2. Ash measurement (%) of three fractions of semi anthracite coal sample before and after alkaline mineral matter removal pretreatment

Sample	Ash (%) without procedure	Ash (%) after alkaline procedure	Decrease (%)
S. A. Coal 0 to 0.053 mm	22.09	4.97	77.50
S. A. Coal 0.088 to 0.074 mm	12.13	7.95	34.46
S. A. Coal 0.147 to 0.088 mm	10.08	6.23	38.19

Alkaline mineral matter removal pretreatment was twice as successful in the smallest fraction of coal (0 to 0.05 mm) than the other fractions.

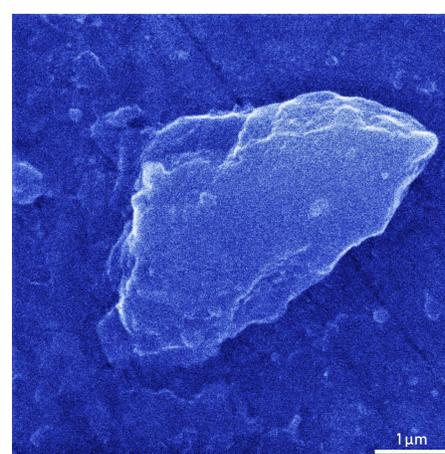


Figure 7. SEM micrograph of coal oxide grain

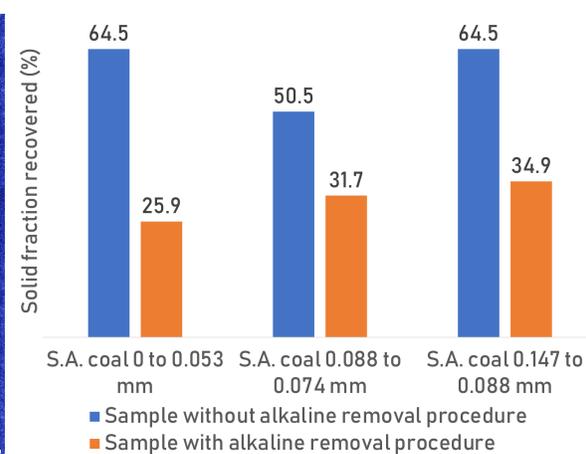


Figure 8. Coal oxide obtaining yield (Solid fraction recovered (%))

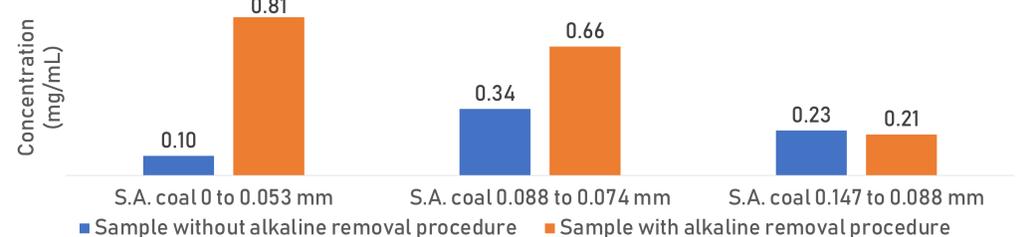


Figure 9. Graphene oxide obtaining yield (mg/mL)

Measurement of GO concentration was carried out by means of UV-Vis spectrophotometry [4]. A calibration curve was made with GO obtained from graphite and compared with the curves obtained from the different samples of GO obtained from semianthracite coal. Smallest grain size samples with alkaline removal of mineral matter pretreatment, the concentration of GO was higher than in the samples without removal of mineral matter.

Conclusions

It was possible to obtain GO from a sample of Colombian semianthracite coal. Also, it was possible to increase the yield in obtaining GO removing the mineral matter from coal samples. Although the coal oxide yield of the samples without the alkaline removal mineral matter process was higher, when obtaining GO, the concentration of the samples with alkaline removal process was higher y two of the samples. The highest concentration of GO was obtained from the semianthracite coal sample size 0 to 0.053 mm with the alkaline removal of mineral matter procedure. Finally, in the case of 0.147 to 0.088 mm sample, the GO concentration was almost the same in the samples that had mineral matter remotion process and those that had not. It may be that due to the size, the vast majority of the sample precipitated during the exfoliation process and it was not possible to obtain graphene oxide.

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