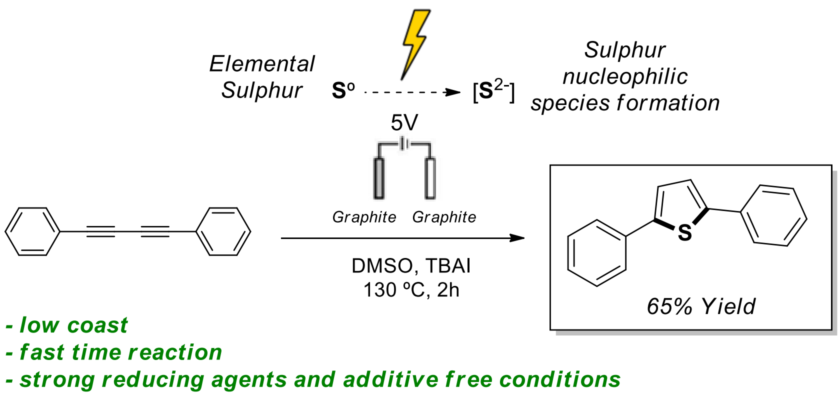
Electroreduction of elemental Sulphur for the synthesis of 2,5-disubstituted thiophenes

Eduardo G. O. Soares,[1*] Douglas Bernardo Paixão[1], Wellington D. G. Gonçalves[1] and Paulo H. Schneider [1]
1) Department of Chemistry, Federal University of Rio Grande do Sul, UFRGS, 91501-970
***e-mail:** eduardosoares.egos@gmail.com*

Keywords: *Chalcogenophenes, electrocatalysis, cyclization.*

ABSTRACT

2,5-Disubstituted chalcogenophenes are a class of compounds widely explored and applied in many research fields, particularly in materials science.[1] The main motivation for synthesizing these heterocycles is their π-conjugation and rigidity, which are often associated with conductive materials in optoelectronic devices.[2] On the other hand, electrocatalysis is an important and growing field in organic chemistry, offering greener and innovative synthetic routes with high selectivity and efficiency,[3] It is well-known that sulphur can be reduced to their binucleophilic species with an applied potential.[4] In this context, a new system for obtaining 2,5-disubstituted chalcogenophenes through electroreduction of elemental chalcogen using graphite as electrode and cyclization from 1,3-butadiynes has been developed. The optimal reaction conditions were established using elemental sulphur and grafite as electrode. The corresponding 2,5-diphenylthiophene was obtained in 65% yield. With these exciting results, the prospects include varying the scope of 2,5-diarylthiophenes and expanding the reaction to synthesize selenophenes analogues.



Several examples were synthesized with this metodology

ACKNOWLEDGEMENTS

The authors are grateful to CAPES, INCT-CMN, FAPERGS.

REFERENCES

[1] (a) Rasmussen, S.; et al. *Chem. Commun*., **2015**, *51*, 4528. (b) Nagahora, N. et al. *J. Org.Chem*., **2018**, *83*, 1969.
[2] Paixão, D. B.; Soares, E. G. O.; Salles, H. D.; Silva, C. D. G.; Rampon, D. S.; Schneider, P. H. Rongalite in PEG-400 as a general and reusable system for the synthesis of 2,5-disubstituted chalcogenophenes. *Org. Chem. Front*., **2022**, *9*, 5225.
[3](a) Zhu, C.; Ang, N. W. J.; Meyer, T. H.; Q, Y.; Ackermann, L. Organic Electrochemistry:Molecular Syntheses with Potential. *ACS Cent. Sci.*, **2021**, *7*, 415. (b) Liu, C.; Li, R.; Zhou, W.; Liang, Y.; Shi, Y.; Li, R.; Ling, Y.; Yu, Y.; Li, J.; Zhang, B. Selectivity Origin of Organic Electrosynthesis Controlled by Electrode Materials: A Case Study on Pinacols. *ACS Catal*. **2021**, *11*, 8958. (c) Kawamata, Y.; Hayashi, K.; Carlson, E.; Shaji, S.; Waldmann, D.; Simmons, B. J.; Edwards, J. T.; Zapf, C. W.; Saito, M.; Baran, P. S. Chemoselective Electrosynthesis Using Rapid Alternating Polarity. *J.Am. Chem. Soc*., **2021**, *143*, 16580.
[4] Martins, G. M.; Meirinho, A. G.; Ahmed, N.; Braga, A. L.; Mendes, S. R. Recent Advances in Electrochemical Chalcogen (S/Se)-Functionalization of Organic Molecules. *Chem. Electro. Chem.,* **2019**, *6*, 5928.