

# A green and fast aromatic iodination procedure II. A mechanistic investigation.

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## Abstract

During the aromatic iodination reaction an iodonium re-oxidation process was observed when using glycerine as solvent.

## Introdução

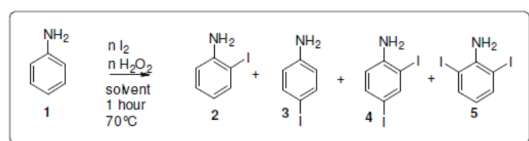
Aromatic compounds bearing a halogen atom are among the most useful building blocks in synthetic organic chemistry, pharmaceutical industry and agrochemical industries. Its versatility comes from the easy with they form new carbon-carbon bonds, allowing diverse functional transformations<sup>1</sup>. Chlorine and bromine are very reactive and their corresponding electrophilic aromatic substitution reaction is well known and useful. Iodine, however, is the least reactive of the halogens and is introduced essentially by two methods: a) by displacement of another group such as carbonyl or diazonium salt (Sandmeyer reaction) or b) by electrophilic iodine substitution reaction of a C-H bond.<sup>2</sup> In a previous communication was reported yields of 85% or higher when aniline was reacted with electrophilic iodine.

Here we report an in depth study of the electrophilic iodine formed under several conditions using water, acetonitrile, ethanol or glycerol as solvent and H<sub>2</sub>O<sub>2</sub> as oxidant.

## Resultados e Discussão

Iodine is very soluble in acetonitrile and oxidation of iodine in presence of 4 equivalents of HCl using H<sub>2</sub>O<sub>2</sub> quantitatively forms HICl<sub>2</sub>,<sup>3</sup> as proved by UV analysis. On the other side, iodine sixteen times more soluble in glycerol than it is in water and reacts, using the previous conditions, faster than in water or ethanol.

To investigate the effect of solvent on the reactivity of iodine towards aniline we mixed both in a proportion of 1:0,5 equivalents using water or glycerol as solvent. After 24 hours at 70°C the *p*-iodoaniline was identified by GC- *o*-iodoaniline and 2,4-diiodoaniline were observed.



**Scheme 1.** Synthesis of iodo-aniline products.

**Table 1.** Preliminary results of aniline iodination.

Entry	Solvent	2*	3*	4*	5*
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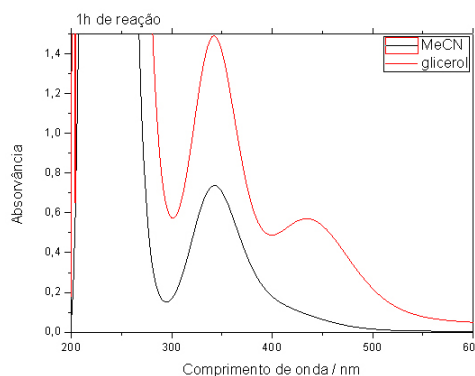
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1	Glycerol(n=0,5*	11	59	0,9	0,0
2	Water(n=0,5)**	22	40	8,7	0,0
3	Glycerol(n=0,5)	5,2	89	2,0	0,2
4	Glycerol(n=1,0)	0,2	49	51	0,0
5	Glycerol(n=1,5)	0,0	10	91	0,0

\*conversion determined by gas-chromatography (%)

\*\*reaction time = 24 hours without H<sub>2</sub>O<sub>2</sub>. Entries 3,4and 5 isolated yield.

To investigate the iodine consumption during the reaction using 4 equivalents of HCl as activating agent was possible to observe an iodine re-oxidation process after 17 h reaction. Using acetonitrile in place of glycerol does not shows any evidence for the same process as can be seen in the UV spectra below.



**Figure 1.** Glycerol and acetonitrile comparison.

On the other hand, using 10% mol of HCl as catalyst, almost quantitative yields of 5-iodoanthranilic acid and 4-iodoaniline were isolated.

## Conclusões

The re-oxidation process was observed when water or ethanol was used and more experiments are being made to elucidate this behavior.

## Agradecimentos

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<sup>1</sup> S. S. Kahandal, S. R. Kale, M. B. Gawande, R. Z. Rajender S. Varma and R. V. Jayaram, *RSC Adv.*, **2014**, *4*, 6267

<sup>2</sup> C. Frota, G. A. Casagrande, L. Pizzuti and C. Raminelli, *Curr. Org. Synth.*, **2013**, *10*, 265-287

<sup>3</sup> Bedrac, L. and Iskra, J., *Adv. Synth. Catal.* **2013**, *355*, 1243–1248.