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Intrinsically colored red aromatic polyamides

Patricia D. Peredo-Guzmán, Miriam Trigo-López, Saúl Vallejos-Calzada, Félix C. García-García, José Miguel-García.

Chemistry Department, Faculty of Science, University of Burgos, Plaza Misael Bañuelos s/n, 09001 Burgos, Spain.

Emails: pdperedo@ubu.es, mtrigo@ubu.es, svallejos@ubu.es, fegarcia@ubu.es, jmiguel@ubu.es.

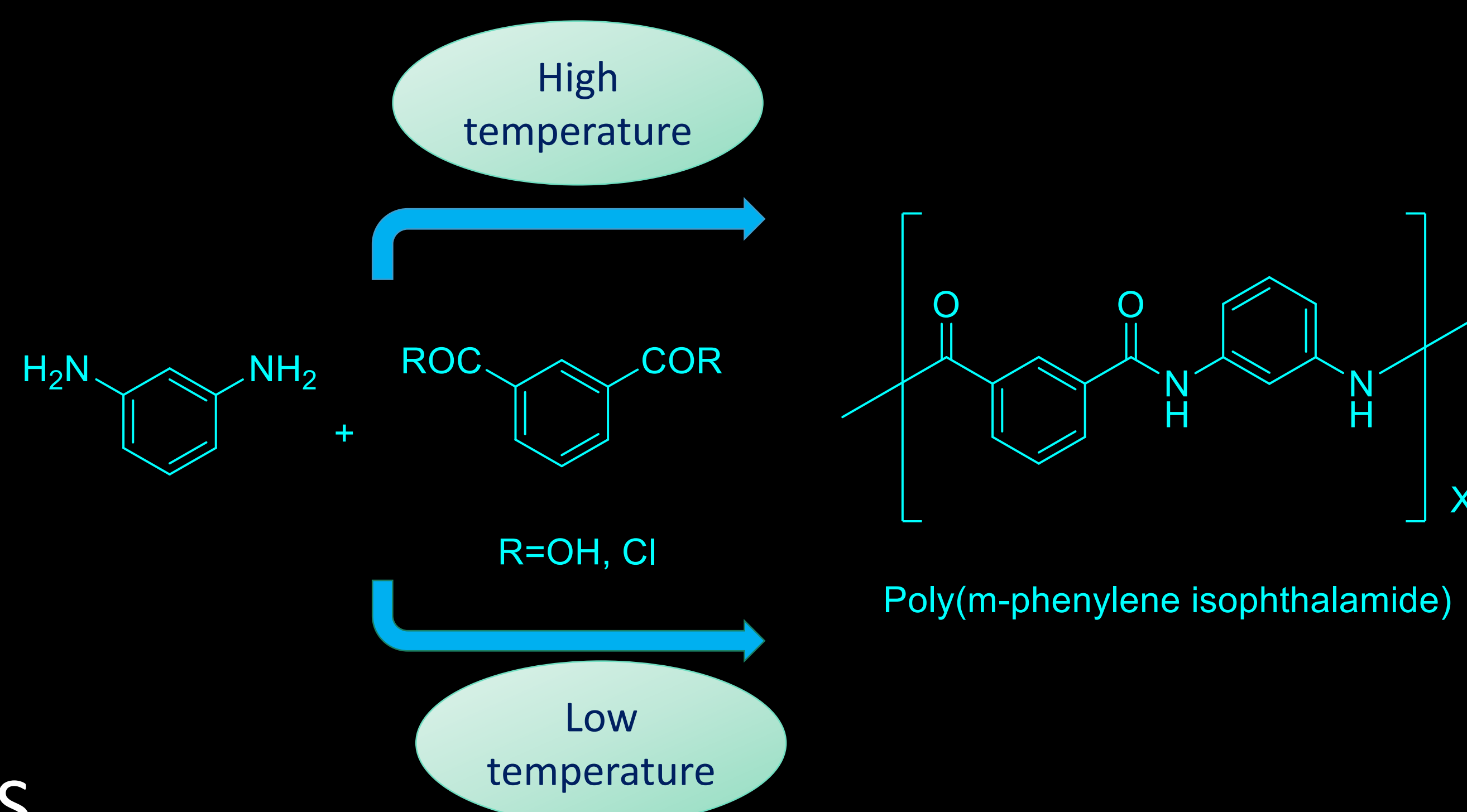
Aromatic polyamides or aramids are materials with exceptional thermal and mechanical properties. For this reason, they are considered high-performance materials with a multitude of applications in fields such as civil security (bullet-proof body armour or fire, chemical and saw protection suits), transport (automotive and aerospace) and civil engineering, among many others. Although in some industrial applications the natural yellowish colour of the fibres is used, generally most of the applications require coloured fibres. However, aramid fibres have poor dyeing properties, for the same reasons that make them thermally and mechanically resistant, and traditional dyeing methods such as dope dyeing, are inefficient and aggressive, which impairs fibres properties.

Ideal colour fastness of fibres is achieved by intrinsically, inherently or self-coloured polymers, by introducing a dye motif or chromophore monomer in the chemical structure of the polymer.

METHODS

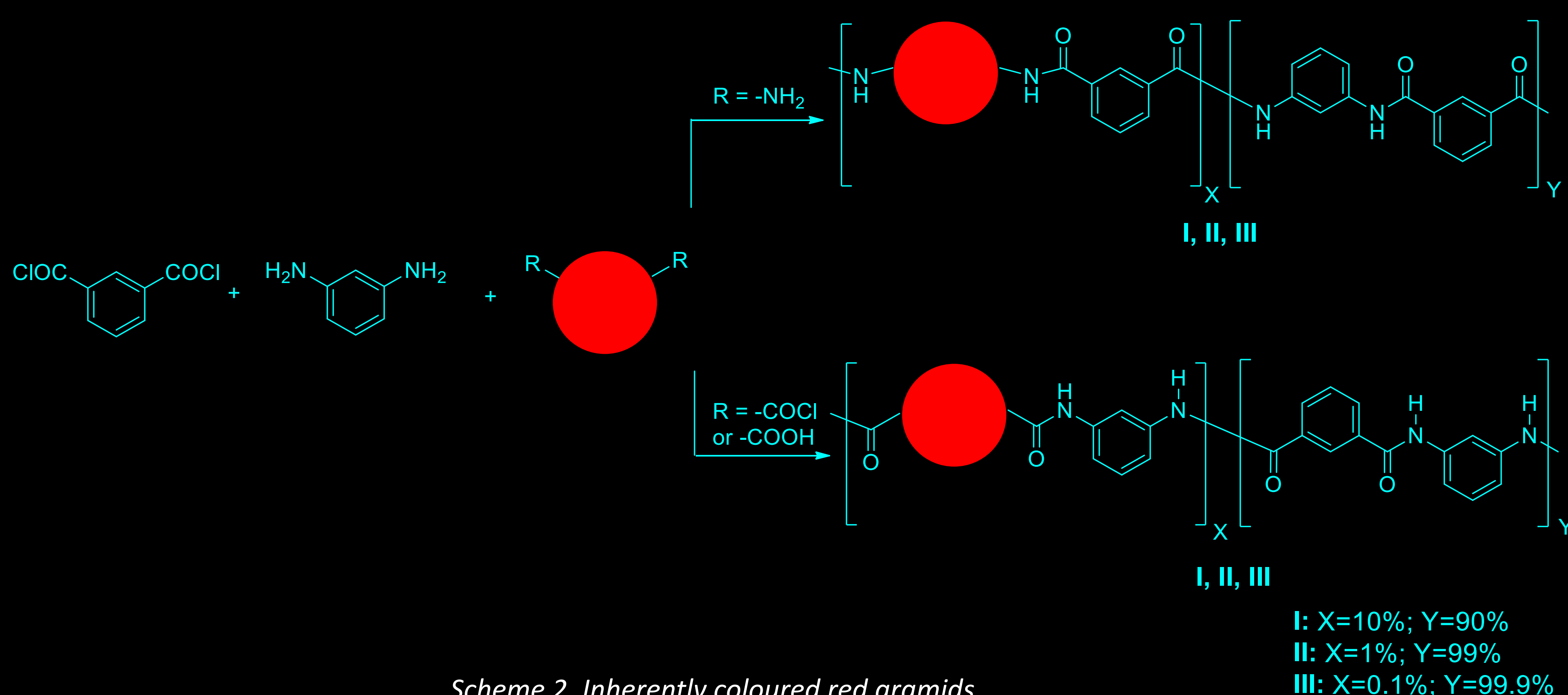
1. GENERAL SYNTHESIS

Aramids are prepared from difunctional monomers: diamines and diacids, or their reactive derivatives by polycondensation of diacids and diamines at high temperature by the Yamazaki-Higashi method or, preferably, at low temperature by reaction of diamines and diacid chlorides (Scheme 1).



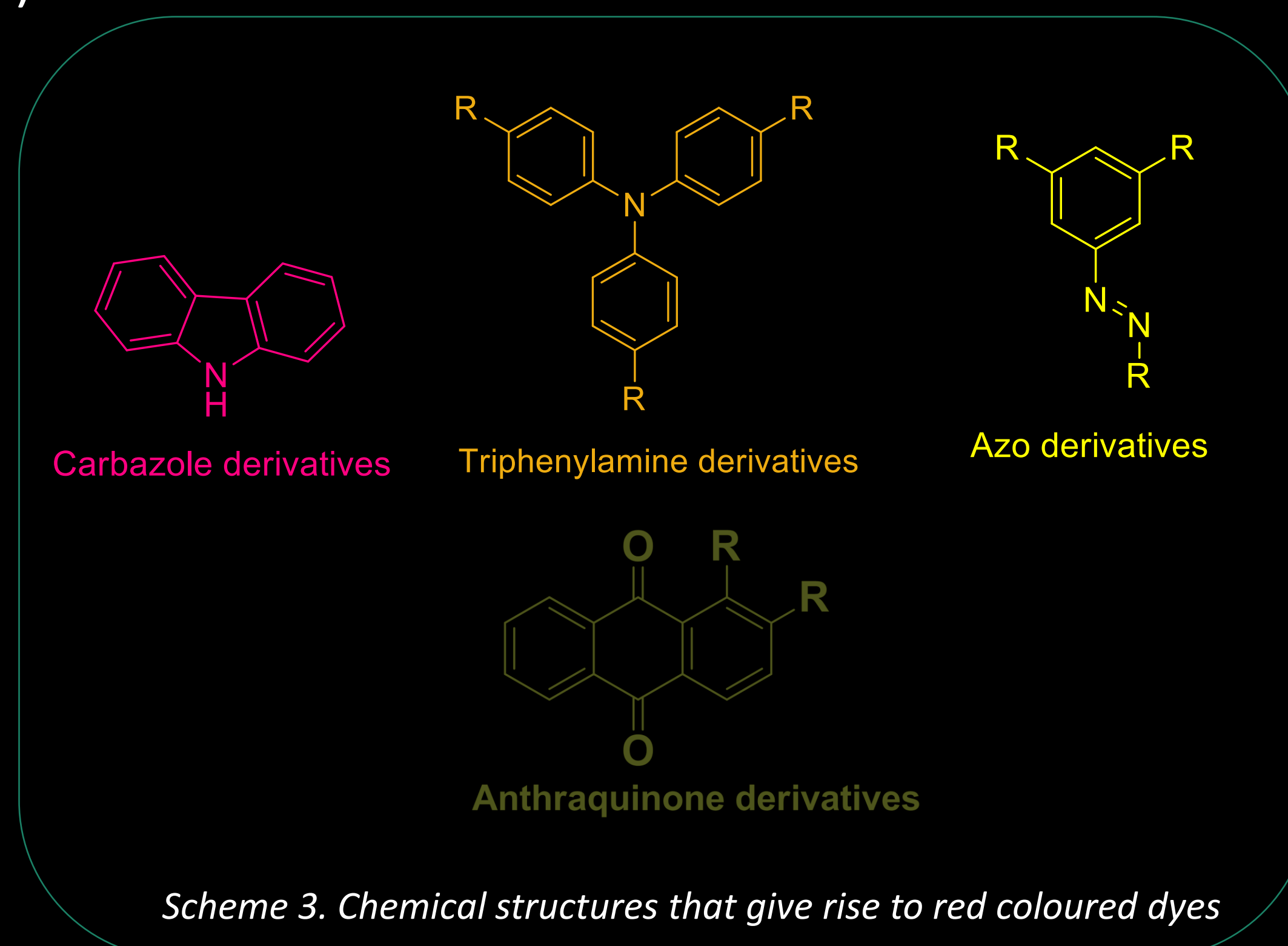
Scheme 1. General synthesis of Aromatic polyamides

2. SYNTHESIS OF INHERENTLY COLOURED RED ARAMIDS



Scheme 2. Inherently coloured red aramids

Commercial m-phenylenediamine and isophthaloyl chloride were used together with a red colour monomer, coloured chromophore can be both a diacid (or a diacid chloride) or a diamine, in different molar proportions in order to obtain copolymers with different red colour hue (Scheme 2).



Scheme 3. Chemical structures that give rise to red coloured dyes

Red is one of the highest demanded colours in the market of civil security and protective aramid fibres after blue colour, and it is also difficult to be obtained. Red dyes are based on the use of the following chemical structures which give red, yellow and orange colors (Scheme 3).

RESULTS AND CONCLUSION



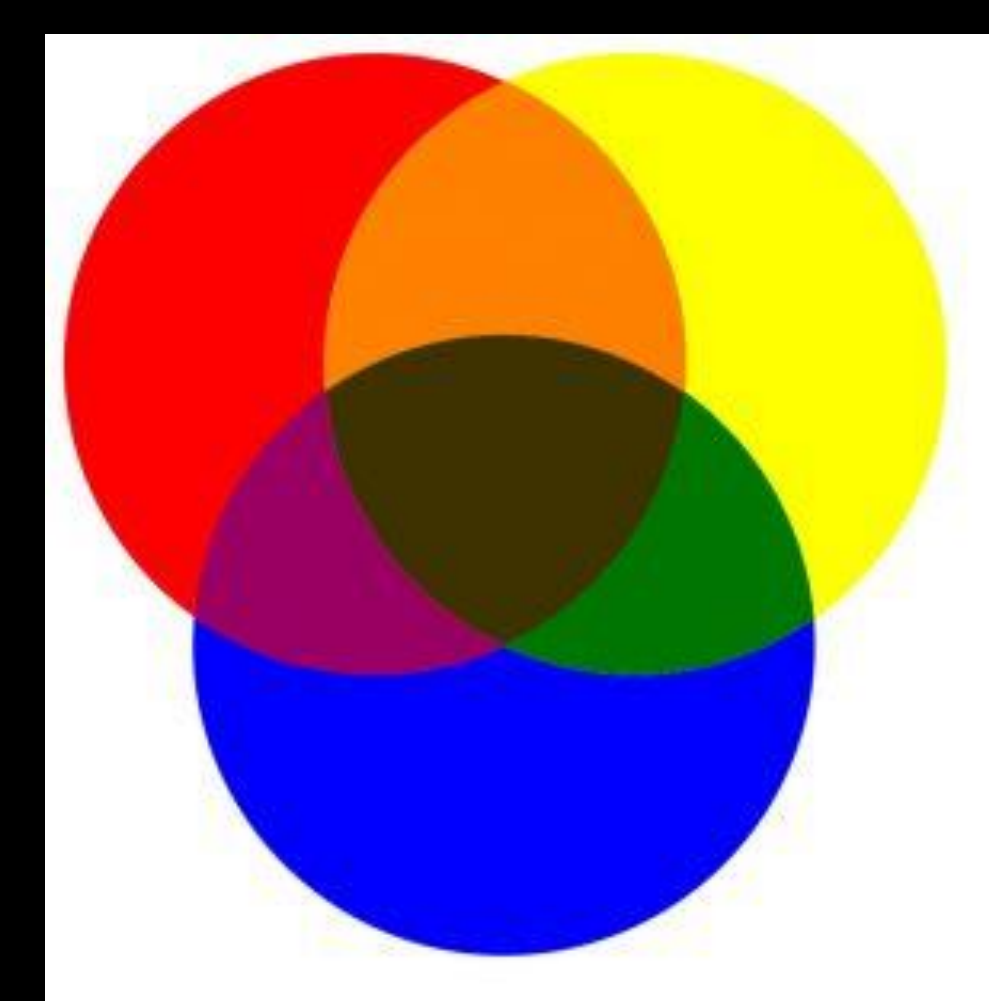
We have already obtained inherently blue coloured aramids.



Our aim now is to obtain red and yellow coloured aramids prepared in the same fashion.



The combination of primary colors will allow us to obtain the full range of colors.



References

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