

EXAMEN : Baccalauréat général - Série S-SVT ou S-SI	Session 2013
ÉPREUVE : Evaluation spécifique de Langue en section européenne	
PHYSIQUE-CHIMIE en langue ANGLAISE	
Thème : Chimie et environnement	Sujet n°6

A green ibuprofen

Ibuprofen is the main active ingredient in many painkillers. The original synthetic route involved six consecutive steps and had an overall atom efficiency of just 40% of the mass of all the atoms going into the process, 60% ended up in waste products.

In the early 1990s, the BHC company (now part of BASF) redesigned the synthetic route using many of the principles of green chemistry. The same chemical transformation occurs, but it is achieved in very different ways. Originally, aluminium trichloride was required to promote the reaction. To get a high-yielding reaction, the aluminium trichloride was needed in excess (in larger quantities than the theoretical amount suggested by the reaction equation), adding to the waste problem.

But in the green route, hydrofluoric acid is used to promote the reaction instead of aluminium trichloride. Because it is used as a catalyst, only a small amount of the acid is required; even better, it is recycled and so it can be used again. In this way, a large amount of solid waste was eliminated from the process.

The green route thus produces more ibuprofen in less time and using less energy than the original process — which means cheaper products for the consumer with increased profits for the manufacturers.

yielding = rendement

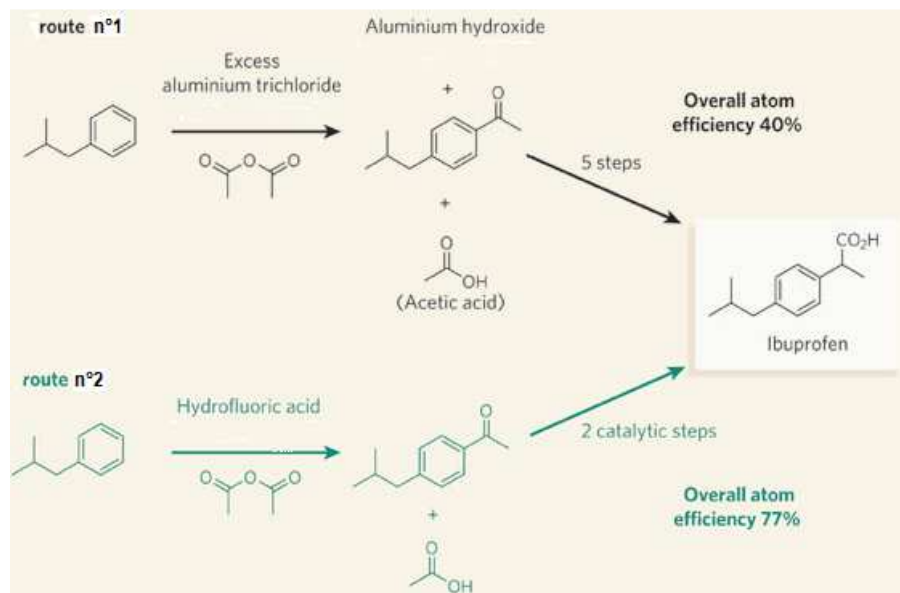


FIGURE 1: Two routes to synthesize ibuprofen

From: <http://portal.acs.org> and <http://www.nature.com>

QUESTIONS

1a- Present and comment on the document explaining why route n°2 can be called a “green route”?

1b- Using the text, the figures and your personal knowledge, explain the role of a catalyst.

2- According to you, how can science contribute to overcoming the challenge of sustainable development?