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**Residence time distribution in a solar reactor on a pilot scale:  
Application to the treatment of organic pollutants in a continuous  
system by UV/chlorine**

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## Abstract

In our experiments we conducted the study of the residence time distribution in order to understand the hydrodynamics of a solar reactor type CPC by applying the advanced oxidation processes for the treatment of organic pollutants; BB41 in continuous system by sodium hypochlorite NaClO without and with exposure to sunlight.

Sodium hypochlorite (NaClO) exhibited superior photocatalytic degradation efficiency for BB41 dye under solar irradiation.

The UV/NaClO process proved to be highly effective for BB41 dye degradation in a solar reactor.

The experimental design method was applied to solar reactor results, which saves our time and analyzes results and studies the effect of chlorine concentration, BB41 concentration, chlorine flow rate and other factors in several conditions.

From the previous studies, the optimum values for achieving a 81.55% of conversion rate: are: 40 l/h for the chlorine flow rate, 6 mm for chlorine concentration, 300l/h for the dye flow rate, a PH of 8.1 and a temperature of 25°C.

## Key words

Wastewater treatment; dyes; Photoreactors; Advanced oxidation process; step injection Residence time distribution.

## المخلص

في تجاربنا، أجرينا دراسة لفهم الديناميكا الهيدرولوجية لمفاعل شمسي من نوع CPC عن طريق تطبيق عمليات الأكسدة المتقدمة لمعالجة الملوثات العضوية، وتحديدًا للصبغة BB41، في نظام مستمر باستخدام هيبوكلوريت الصوديوم NaClO دون تعرض لأشعة الشمس ومعها. أظهرت هيبوكلوريت الصوديوم (NaClO) فعالية متفوقة في تحلل الصبغة BB41 تحت تأثير الشمس، وكذلك أثبتت عملية الأشعة فوق البنفسجية/NaClO فعاليتها العالية في تحلل الصبغة BB41 في المفاعل الشمسي.

تم تطبيق طريقة التصميم التجريبي على نتائج المفاعلات الشمسية، والتي توفر الوقت وتساعد في تحليل النتائج ودراسة تأثير تركيز الكلور والصبغة BB41 ومعدل تدفق الكلور وعوامل أخرى في ظروف متعددة.

القيم الأمثل لتحقيق معدل تحويل بنسبة 81.55% هي: 40 لتر/ساعة لمعدل تدفق الكلور، 6 ملم لتركيز الكلور، 300 لتر/ساعة لمعدل تدفق الصبغة درجة الحموضة 8.1 ودرجة الحرارة 25°C

## الكلمات المفتاحية

معالجة مياه الصرف الصحي. الاصباغ. المفاعلات الضوئية عملية الاكسدة المتقدمة. توزيع وقت الإقامة.

## Résumé

Dans nos expériences, nous avons étudié la distribution des temps de séjour afin de comprendre l'hydrodynamique d'un réacteur solaire de type CPC, en appliquant des processus d'oxydation avancés pour le traitement des polluants organiques ; BB41 dans un système continu avec du hypochlorite de sodium NaClO, avec et sans exposition au soleil.

Le hypochlorite de sodium (NaClO) a montré une efficacité de dégradation photocatalytique supérieure pour le colorant BB41 sous l'irradiation solaire.

Le processus UV/NaClO s'est avéré très efficace pour la dégradation du colorant BB41 dans un réacteur solaire.

La méthode de conception expérimentale a été appliquée aux résultats du réacteur solaire, ce qui permet d'économiser du temps et d'analyser les résultats ainsi que d'étudier l'effet de la concentration de chlore, de la concentration de BB41, du débit de chlore et d'autres facteurs dans plusieurs conditions.

D'après les études précédentes, les valeurs optimales permettant d'atteindre un taux de conversion de 81,55 % sont les suivantes : un débit de chlore de 40 l/h, une concentration de chlore de 6 mm, un débit de colorant de 300 l/h, un pH de 8,1 et une température de 25 °C.