

CHEMISTRY PRACTICES AIMED AT NON-UNIVERSITY LEVELS OF EDUCATION

M.J. Rojo Cámara, M.T. Rodríguez Rodríguez, T. Torroba Pérez

Departamento de Química, Área de Química Orgánica. Universidad de Burgos (SPAIN)

Abstract

One of the challenges at the forefront of science education is the progressive loss of student interest in subjects that are studying, for what a return to the experimental origins can have a positive influence in the spread of the studies of chemistry. In order to increase the number of enrolled students, the Faculty of Sciences at Burgos University has carried out some strategies. Teaching Innovation Group at UBU "Inquior" has developed a series of activities aimed at the training of the teaching staff of non-University levels of education and at the divulgation of Chemistry in different education levels. We have participated in various courses and related events such as "The Magic of Chemistry", divulgation Workshops for Primary School Teachers and seminars for Secondary Education Teachers, Vocational Training Teachers and UBU Graduates. In the evaluation of these courses, teachers indicated a high degree of satisfaction, and they found these activities very useful for the development of their teaching.

Keywords: Chemistry divulgation, teaching training, laboratory practices.

1 INTRODUCTION

In relation to the educational labor developed in the secondary education centers and at university we find the concern for awakening the interest of students due to its strong influence on the assimilation of the contents of the different disciplines and also on the scope of the competences to get during the teaching-learning process.

Chemistry is considered by students as a difficult subject. There are many factors that contribute to it, one of them being the disconnect between the chemistry that is studied in the classroom and phenomena observed outside of it.

The lack of interest can have its origin in that science that is taught in the classroom is not attractive; a few concepts based exclusively on the information, opposite to the impact that produce other media as the television or Internet, do not call the attention of students. An incentive for the study of the chemistry can be that students find it relates to something daily and acquaintance [1]. The employment of the daily chemistry like base for the study can be a stimulus.

Particularly striking is the decrease in favorable attitudes towards the learning of science. This may be one of the reasons why lately is being detected a decrease in the number of students choosing science degrees. The academic authorities look for ways to attract students to science careers.

In recent years the Faculties of Sciences, and inside them, the Faculty of Sciences at Burgos University (UBU), are registering, in general, a marked decrease in the number of enrolled students, though some strategies may influence significantly in order to try to reverse this trend.

Among the solutions that could be adopted can be considerate the impulse of the collaboration between secondary education centers and university centers and the promotion of actions aimed at the training of the teaching staff in this regard.

2 RESULTS

Teaching Innovation Group at UBU, Inquior, (Innovation in Organic Chemistry) is involved in a series of activities of divulgation of the Chemistry and the training of the teaching staff of non-University levels of education. With these activities we try to make the chemistry an attractive subject to the students and to provide teachers with materials that allow them to perform with their students, in their centers, attractive laboratory practices [2].

Objectives are also that students at no-University educational levels perform laboratory practices, in the laboratory of Organic Chemistry at the Faculty Sciences of the University of Burgos.

We have participated in various courses and related events:

- The Magic of Chemistry: aimed at students from different educational levels and the general public in various exhibitions related to Science and more recently in the Junior FIRST® LEGO® League.
- Divulcation Workshops for Primary School Teachers, in the seminar "Fun Science for primary education: Playing with Chemistry"
- Course "Domestic Chemistry" for Secondary Education Teachers, Vocational Training Teachers and UBU Graduates in which we participated in the seminar "Chemistry and drugs" and as a result of this Seminar, five groups of Secondary school, High school and Professional Training students have carried out Organic Chemistry Practices at Organic Laboratory of the Faculty of Sciences.

2.1 The Magic of Chemistry

A few years ago, in order to promote the interest of students in scientific discoveries in chemistry, we created an advanced viewing experience of a series of classic chemistry experiments, though not so well known, that takes the viewer to a total immersion on fundamentals principles explicated in very attractive way at the same time as of high scientific level.

Some scientific experiments that give rise to colours, vapours and lights, are a classic expression of the principles of chemistry, which is also present in technology and living matter. The composition and internal structure of matter can be understood by attractive experiments that create a lasting impression, and at the same time they can inspire reflection on the most basic aspects of the chemistry. The experiments can be extremely attractive and concepts as basic as the air, time and light acquire a great intensity when they are seen from the point of view of chemistry.

They have been conducted (a) cryogenic experiences to show how the most common substances behave at different temperatures and in different states of aggregation (Fig.1).



Figure1. Cryogenic experiences

(b) Acid-base and redox experiments using the components of air, or generating them in situ in appropriate experiments (Fig. 2)



Figure 2. Acid-base and redox experiments

(c) Temporal experiences by oscillating reactions to demonstrate the principles of behavior of matter in states far from equilibrium (Fig. 3).



Figure 3. An oscillating coloured reaction experiment with the aerial oxygen.

(d) Light generating experiences by conventional luminescent reactions, through luminol or the generation of singlet oxygen in the presence of a fluorescent dye (Fig. 4).



Figure 4. Luminescent reactions

Some of these experiences have been reflected in the books and professional videos published by the community of Madrid [3].

2.2 Workshops for Primary School Teachers

These Divuligation Workshops for Primary School Teachers were carried out at Faculty of Science. In these workshops, our Teaching Innovation Group was the responsible for the organization of the seminar "Fun Science for primary education: Playing with Chemistry".

The session started with a theoretical introduction (between half and one hour) followed by laboratory practices to complete three-hour practice session.

A booklet that included each of the experiences with the steps detailed with high accuracy was made.

Primary school teachers performed the following laboratory practices:

- a) Colours separation of markers:

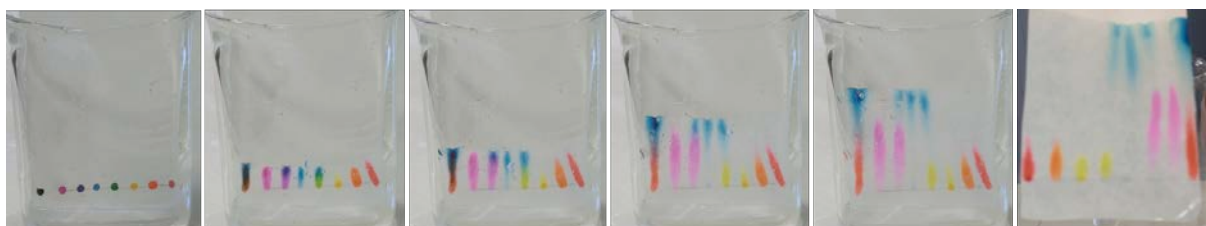


Figure 5. Colour separation of marker

- b) Synthesis of Blandiblu



Figure 6. Synthesis of Blandiblu

- c) The bouncing ball



Figure 7. The bouncing ball

2.3 Course "Domestic Chemistry" for Secondary Education Teachers and Vocational Training Teachers

The course "Domestic Chemistry" for Secondary Education Teachers, Vocational Training Teachers and UBU Graduates was organized by the Institute for Training and Educational Innovation at UBU. Our Teaching Innovation Group participated in the seminar "Pharmaceuticals".



The seminar started with one hour conference about "Chemistry and drugs" followed by laboratory practices to complete two-hour practice session.

This seminar caused great interest among participant teachers and as a result of it, five groups of Secondary School, High School and Professional Training students have carried out Organic Chemistry Practices at Organic Laboratory of the Faculty of Sciences. They synthesized aspirin and

paracetamol and after that, they used thin-layer chromatography to identify compounds presents in a given mixture.

In Fig. 8 we can see non-university students performing laboratory practices.



 **Junta de Castilla y León** 

CURSO

QUÍMICA DOMÉSTICA

(15 horas –1,5 créditos)

Dirigido a profesores de educación secundaria y formación profesional de áreas científicas y técnicas y Titulados UBU

PROGRAMA DEL CURSO

4 de febrero, jueves: ALIMENTOS

- Presentación del curso. Alvaro Colina Santamaría, profesor titular de Química Analítica de la Universidad de Burgos.
- Química y alimentos. M^a Dolores Rivero Pérez, profesora contratada doctora de Tecnología de los Alimentos y Miriam Ortega Heras, profesora ayudante doctora de Tecnología de los Alimentos de la Universidad de Burgos.
- Talleres prácticos.

11 de febrero, jueves: COSMÉTICOS

- Química y cosméticos. M^a Angeles García García y Susana Palmero Díaz, profesoras contratadas doctoras de Química Inorgánica de la Universidad de Burgos.
- Talleres prácticos.

16 de febrero, martes: PRODUCTOS DE LIMPIEZA

- Química y productos de limpieza. Gabriel García Herbozo, catedrático de Química Inorgánica de la Universidad de Burgos.
- Talleres prácticos.

18 de febrero, jueves: PRODUCTOS FARMACÉUTICOS

- Química y medicamentos. Tomás Torroa Pérez, catedrático de Química Orgánica de la Universidad de Burgos, M^a Teresa Rodríguez Rodríguez y M^a Josefa Rojo Cámara, profesoras titulares de Química Orgánica de la Universidad de Burgos.
- Talleres prácticos.

LUGAR Y HORARIO

Salón de actos de la Facultad de Ciencias de la Universidad de Burgos. Pza. Misael Bafuelos s/n



Figure 8. Laboratory practices

3 CONCLUSIONS

Teaching Innovation Group at UBU “Inquior” has developed a series of activities aimed at the training of the teaching staff of non-University levels of education and divulgation of Chemistry in different education levels.

The experiences were very positive, both for those who participated in the workshops and for the teachers who taught in the seminars, since in the evaluation of the courses, they indicated a high degree of satisfaction, and they found the activities very useful for the development of their teaching.

In particular, in the course for Secondary Education Teachers and Vocational Training Teachers a considerable number of teachers have come to the laboratory of organic chemistry with their students to perform the same session of practices that they carried out.

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