Ten differences between chemistry and chemical engineering

It's a common problem that people do not understand the difference between chemists and chemical engineers. Both fields are becoming increasingly important and deserve greater public recognition, but they are distinct.

This list is in no way definitive, and there are huge overlaps in the work of chemists and chemical engineers, but here's some key differences between the two disciplines:

1. Recognition

The most apparent difference between chemists and chemical engineers is recognition. The public at large understand what a chemist does (because they studied chemistry in school), but there is a lack of recognition of what chemical engineering is.

Perhaps the highest form of recognition for both chemists and chemical engineers would be winning a Nobel Prize. The Nobel Prize in Chemistry has been awarded to 166 laureates since 1901 but only six of these winners can be classified as chemical engineers; Koichi Tanaka, Jon B. Fenn, Kurt Wuthrich, Linus Carl Pauling, William Francis Giauque and Robert H. Grubbs. As a collective, chemical engineers need to get better at being advocates for their work.

2. History

Chemistry and the study of it is deeply rooted in history, going back to ancient times. Records show that ancient civilisations amassed practical knowledge of chemistry involved in metallurgy, pottery and dyeing. The study of chemistry as a science began in the 1600s, with chemists like Robert Boyle working towards the formulation of Boyle's Law.

Chemical engineering emerged in its own right during the late 1800s with George E Davis coining the term 'chemical engineering'. Increased understanding of the importance of chemical engineering after World War I led to IChemE being established in 1922.

3. Numbers

There are more chemists than there are chemical engineers, perhaps explaining why chemistry is more readily recognised. For example; 5255 students were accepted to study chemistry last year in the UK, compared with 3300 for chemical engineering.

However there is good news for chemical engineering. In the last decade, applications to study chemical engineering and chemistry in the UK have increased by 135% and 35% respectively. Obviously not all these students will go on to work as chemists or chemical engineers, but increasing numbers of students are a good sign for both fields.

4. Area of study

Chemistry investigates the background of the science encompassing aspects of; organic, inorganic, analytical, physical, and bio-chemistry. Chemical engineering is more multidisciplinary and practical, applying engineering science to problems relating to heat transfer, fluid dynamics, equipment design etc. Engineering science is different to natural science as it studies human artefacts, rather than nature. Here is a good YouTube video explaining this in a bit more detail.

5. Focus

Chemists tend to focus on developing novel materials and processes, analysing substances, measuring the physical properties of substances, and testing theories. Chemical engineers focus on turning these new ideas and discoveries into useful products that are attainable. Most work falls into the design, construction and operation of plants and machinery, focussing on making products for profit and on a scale that is accessible to the many.

6. Salary

Chemical engineers generally get paid more than chemists. The starting salary of a chemical engineer is around £28,500*; the starting salary of an analytical chemist is £22,000. This does not change with career progression; senior analytical chemists could earn over £50,000 but Chartered Chemical Engineers can earn £70,000+.

7. Careers

Both chemistry and chemical engineering are good subjects to study and the skills learnt can be applied to a variety of different jobs and roles. Typical jobs within the field of chemistry include; analytical chemist, clinical biochemist, forensic scientist, pharmacologist, research scientist or toxicologist. The skills learnt in studying chemistry can also be applied to being an accountant, environmental consultant, patent law, teacher, or science writer. Chemists can even go on to become chemical engineers.

Chemical engineers can fill a wide range of roles in a variety of disciplines including; chemical engineer in the water industry, bioproduct engineer, food processing engineer or process engineer in the energy industry.

8. Place of work

Chemists tend to work in laboratories performing analysis or research and development, but can also be found in offices, classrooms and in the field. As a chemical engineer's job is likely to be more practical - ie in the design or operation of a plant - they tend to work in offices or in the field.

9. Scale

Chemists work with relatively small amounts of materials in glassware or on a laboratory bench, for example when developing new drugs. Chemical engineers work on industrial scale reactions with factory size equipment, for example they would be responsible for scaling up drug production to create thousands of units.

Chemists are more likely to develop novel products; chemical engineers then take these products and make them more efficient so they are widely available and cheap.

10. Diversity

The bodies of chemistry and chemical engineering have both worked hard to promote diversity within the fields and both have seen success. In 2016, 44 per cent of applications to study chemistry were from women, a good sign for gender equality. Applications from women to study chemical engineering was 28% of the total, the highest amount in all the engineering professions. We chemical engineers need to do even more work to achieve a better gender balance.

*Source: IChemE Salary Survey 2016.