The Chemical History of a Candle

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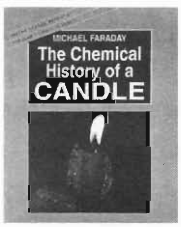

The Chemical History of a Candle
Michael Faraday
Vigyan Prasar Reprint, Vigyan Prasar
C-24, Qutab Institutional Area
New Delhi 110 016, India
p.146, Rs. 35/-.

"Without Observations and Experiments our natural philosophy could only be a Science of Terms and an unintelligible jargon."

– J T Desaguliers (1683–1744) in his book *Course of Experimental Philosophy*

Michael Faraday, who had little schooling but excellent education during his tenure as assistant to the famous Humphry Davy, went on to become one of the most effective proponents of science. His masterly exposition of the subjects he spoke on and the well thought out experiments that supported them formed the nucleus around which Faraday successfully conveyed the joy of doing science to the young and the old alike – skills that would have made Desaguliers proud.

The book under review is an excellent material to study not only the chemical history of a candle but to illumine us on Faraday, the supreme observationist and an experimenter par excellence.

The book is, actually, a written record of the six lectures[1] he delivered at the Royal Institution during the Christmas holidays of 1860. Faraday himself had introduced the tradition of Christmas lectures to the 'juvenile auditory', as he put it, in 1826. The same year also saw another great tradition started -- the Friday Evening Discourses. Since then, the two programmes have inspired a number of 'juveniles' to pursue a career in science. And, they continue to this day. So, it is not at all an exaggeration when we hear Humphry Davy, the discoverer of several elements as well as the famous Davy's safety lamp, admit that his greatest discovery was Faraday!

The greatness of Faraday as an articulate speaker and skillful experimenter shines through the book on Candle. The experiments are simple, easy to perform and unambiguous in demonstrating the scientific principles they are intended to. Some of the experiments if introduced in the regular school syllabus would make great impact on the learning outcome. For instance, capillary action is introduced with an experiment involving saturated salt solution and a column of salt crystals. The experiment conveys the concept most dramatically. But, we do not find this experiment in any book even at undergraduate level. It is no wonder that, the topic of candle captured the minds of the young amateur scientists of the time. Faraday, in fact, repeated the lectures on public demand on more than two occasions. The first time was

[1] The first lecture is excerpted in pp.90-98 of this issue.

in 1848. The book was published in 1861. Since then, the book has hardly been out of circulation. It tells us two things. That, we may not be most knowledgeable about the most familiar things. Secondly, that even a commonplace object like a candle, in the hands of a diligent observer can be transformed into matter of scientific curiosity. In fact, Faraday himself sets the tone at the very beginning of the lecture series when he says:

" There is no better, there is no more open door by which you can enter into the study of natural philosophy than by considering the physical phenomena of a candle."

What follows is a wonderful excursion into the history of candle making, the structure and behaviour of the flame, the mechanism by which molten wax is carried to the tip of the wick. There are lots of interesting questions Faraday poses and goes on to answer through excellent demonstrations. The one that illustrates the mechanism of wax rising up the wick is very good. I guess, not many students would be aware of the finer aspects. The wax rising up is much more than the capillary action that is often invoked to answer the question.

Here is a description of the flame by Faraday:

"It is steady and equal, and its general form is that which is represented in the diagram, varying with atmospheric disturbances, and also varying according to the size of the candle. It is bright, oblong, brighter at the top than towards the bottom, with the wick in the middle, and besides the wick in the middle, certain darker parts towards the bottom, where the ignition is not so perfect as in the part above."

Faraday, then goes on to elucidate every observation with further experiments to understand the phenomenon. The interest, intensity and the tempo is more or less the same throughout the six lectures. There is hardly a dull moment in the book. A very wide range of phenomena are covered with a candle as the prop – combustion, factors affecting combustion and products of combustion. The experiments leading to identifying the composition of the products of combustion are very interesting and appear easy only after having read them. At the end, one may be left with a feeling , "Well, even I could have thought of these experiments." Make no mistake. Experiments are simple. But, it takes a Faraday to come out with such ideas.

Though all the lectures are good, the last two are very engaging. The fifth lecture dealing with the nature of the atmosphere and its properties and the last one comparing the process of combustion with that of respiration have very good but less popular demonstrations. Faraday sends a powerful message, actually a reminder, when he says:

"So are we made dependent not merely on our fellow-creatures, but upon our fellow existers, all Nature being tied together by the laws that make one part conduce to the good of another."

Vigyan Prasar, which earlier brought to us the reprint of the book on soap bubbles by C V Boys, has done a commendable job in publishing this book. The explanatory notes at the end of the book introducing the reader to scientists and scientific terms is a good addition.

A couple of suggestions to improve the readability of the book

Faraday uses units of measurements like pints, grains, cubic foot and so on. Conversions of these into the relevant measures in SI system would appeal to students. Secondly, a reference to the diagrams could be given in the text itself. There is also immense scope to introduce new diagrams (not present in the original) to help understand some of the experimental set-up. They are not too difficult to figure out either.

Lastly, an appeal to Vigyan Prasar. They should put efforts to make this book accessible at leading bookshops all over the country. There is no point in having a good book that does not reach the intended audience – the students. Today, the largest sales of the book is not in Great Britain or the US. It is in Japan, where it has been introduced to schoolchildren as an experience in observational science. Schools here could very well emulate the Japanese experiment.

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£ note released in UK in honour of Faraday.