

SCI LECTURE PAPERS SERIES

HYDROGENATION

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As early as 1823 Dobereiner noted finely divided platinum caused hydrogen to inflame spontaneously in air. Fifty years later chemists were experimenting with nickel, copper, iron, palladium and other metals not only for hydrogenation but to produce hydrogen from steam and hydrocarbons. Sabatier and Senderens in Toulouse onwards from 1896, developed the catalytic hydrogenation of organic compounds *in the vapour phase* including the conversion of oleic to stearic acid and nitrobenzene to aniline. For several years they remained seriously in error in recommending no liquid reactant should ever cover catalyst surface (1,1a).

Early in 1901 Wilhelm Normann at the Herforder Maschinenfett und Oelfabrik near Hanover showed liquid oils could be catalytically hydrogenated (2), then took out a British patent (3) and came to work at the long established chemical manufacturer Joseph Crosfields at Warrington. Crosfield's wisely bought extensive patent rights from Normann which they were later able to sell on to Jurgens (Netherlands), Schichts (Bohemia) and Procter and Gamble (USA). The Unilever archives have kindly supplied (4) the account by George Crosfield of his company's long and very close association with Normann and Brunner Mond of Northwich.

George relates, "When I entered the firm at the age of 19 I was put under Dr K Markel, a clever chemist who had been appointed some little time before as a manager of the works. Markel's father was German and his mother English. I think it was about 1890 when Markel left Brunner Mond to come to Crosfield's. Markel had great ability and industry but he was obsessed with the idea that no good chemist came out of England and the consequence was that we began to get an overdose of German chemists in the works. Markel realised the importance of Sabatier's patent for hydrogenation with catalytic nickel. It was in Rome, at a meeting of the Society of Chemical Industry, that Dr Markel and myself met Sabatier and I remember Sabatier saying then that he had not had any success with the hydrogenation of liquids and even with bodies in the gaseous state the nickel did not always react. *C'est comme une femme, elle a ses caprices*. Meanwhile Dr Normann of Lohne, near Hanover, had succeeded in hardening oils with catalytic nickel and had obtained a patent for the process. We bought the patent rights from Dr Normann and one of our German chemists, Keyser, was set to work upon it. Keyser achieved some success, so much so that desiring to sell the process to the largest soapmaker in the USA, namely Procter and Gamble, we were in a position to send bulk samples to experiment with."

George then tells how he came to replace Markel as production director then to dismiss two of the German chemists, Keyser in particular who had come to regard himself as indispensable.

"Consequently, I gave him notice and put Mr Fox as manager with most beneficial results. Thanks to Fox and Dr Hilditch, a very clever research chemist and Burlton, our engineer, the hardening process was completely and successfully worked out within two or three years. The hardened oils were successfully used both in soaps and in the edible department. This triumph enabled us to meet with equanimity both Lever's competition and the rising cost of raw materials." In the light of following events this claim has to be regarded as optimistic. No reply being received from Procter and Gamble, George set off for the USA with a bag of samples. He continues, "while in the States I visited Cincinnati and without calling on Procter & Gamble took the opportunity of looking over the fence surrounding their grounds. I was interested to spot Keyser going into one of their outbuildings. I then realised why Procter & Gamble were not coming to terms. However, the action taken with the other soap firms had its effect, Procter & Gamble very speedily buying the process from us."

In 1912 Carleton Ellis, an American member of SCI, gave a very full account of hydrogenation to the New York section (1a). In his book (7) he correctly suggests it is the hydrogen which is dissolved in the oil which reacts, selectivity is feasible and a fresh catalyst may exhibit a brief induction period. By 1913, no less than 183 hydrogenation patents had been recorded in various countries. WH Lever began his own hydrogenation plant at Bromborough in 1912, happily employing pure electrolytic hydrogen which greatly assisted in the 'dead-end' procedure. Brunner Mond, through Crosfield, failed in 1913 when they sued Lever for breach of the Normann patent (5). This ended the practical possibility of any group establishing a world patent (6). Anton Jurgens founded the Oelwerke Germania at Emmerich in 1912 and took Normann into his employ there. WR Jackson of Crosfield helped start the new plant (5). Jurgens and van den Bergh succeeded in 1920 – where Lever had failed in 1913 – in persuading Schicht of Aussig [now Usti nad Labem] to join them, Lever being explicitly excluded (6) until 1929 when Unilever was formed.

Exercising considerable diplomacy Lever had formed good relations with Procter & Gamble as early as 1914 and later obtained advice on how best to hydrogenate vegetable oils to shortening. Naturally this correspondence was kept under lock and key but after some 40 years I got the key – it went with my new job as plant manager. It made a good 'read'. I was edified and a little humbled to find such sound advice coming from so far away and so long ago. Another twenty-five years passed then Bob Hastert invited me to speak at the AOCS 1986 colloquium on hydrogenation in Hawaii. At long last I was able to voice my thanks to the many Procter & Gamble people present and apologize for the delay.

According to George Crosfield, in about 1910, he and his brother sold a controlling interest in their company to Brunner-Mond, stipulating however, that the shares in question should never pass to Lever who was then a competitor of Schicht of Aussig to whom Crosfield had a commitment. In 1915, believing this stipulation had been infringed, they resigned. In 1919 Lever did gain full control. In 1997 Unilever sold Crosfield and Oelwerke Germania to ICI. After 1945 Schicht were nationalised by the communists (6a). Even so I was well received and enjoyed an interesting and successful visit as private consultant when I visited Aussig in 1983 and I was reminded then that they had been part of Unilever. They were privatised when the communists fell and now trade as Setuza (STZ).

References

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