RESEARCH TOPICS

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# From Natural to Synthetic? Rethinking Narratives of Chemical "Replacement" in the Nineteenth and Twentieth Centuries

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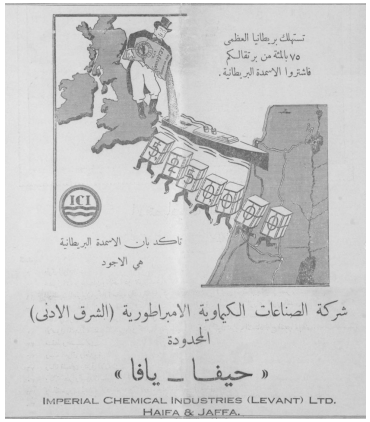
Since the early twentieth century the world has seen a proliferation of new materials, many of them invented in scientific laboratories and mass-manufactured in factories. Artificial fibers, oil, rubber, and other synthetic materials have been widely heralded by chemical manufacturers, market stakeholders, and research institutions as superior to their natural counterparts based on their cost-effectiveness, ease of production, and high quality. And chemists have aimed not only to mimic nature but also to transcend it, striving to overcome the limitations of extracting raw materials and to create compounds that nature never produced, ultimately maximizing self-sufficiency on a grand scale.




03 A fertilizer advertisement by the largest agrochemical company in Palestine. *Al-Iqtisadiyyat al-'arabiyya*, July 15, 1935. Source: Jrayed: Arabic Newspapers of Ottoman and Mandatory Palestine, the National Library of Israel.

could be spared from rural Palestinian staple cultivation, where it was commonly used. To fill the plant nutrient gap, synthetic fertilizer was suggested as a solution that was not only economically superior but could also animate an agrarian transformation of rural Palestine from "primitive" and extensive cultivation to "modern" and intensive based on the Jewish model. In Palestine, transnational scientific expertise embedded within local colonial agricultural modernization discourse therefore formed the conditions in which "organic" was to be substituted with "synthetic" fertilizer, resulting in the endurance of the natural alongside the synthetic.

## Challenging "Replacement" Narratives of Natural and Synthetic Materials

Together, the cases of indigo dye, camphor, and fertilizer show how substituting natural material with its synthetic alternative was a multilayered, even decades-long process, not merely a straightforward replacement of an obsolete technology with a superior one. The shift from natural to synthetic was shaped by a range of factors such as public concerns around authenticity, and through corporate marketing strategies, political and economic influences, and discourses around scientific modernization. This story of complexity has a contemporary as well as historical relevance: since crises such as climate change and pandemics can quickly alter material use and perception, a further understanding of the social nuances of material advancements will be crucial for adapting to future societal shifts.

ABOUT THE AUTHORS

**Lejie Zeng's** research examines the interrelations between synthetic dyes from Europe and natural dyes from China in the context of the industrialization of chemistry from the late nineteenth to mid-twentieth century.

**Jonathan Haid** studies the history of nitrocellulose in the nineteenth- and twentieth-century humanities, with special attention to the relationship between media technologies and their raw materials.

**Omri Polatsek's** work focuses on Egypt's growing reliance on fertilizers and pesticides from the late nineteenth to mid-twentieth century, studying the knowledge and resources that enabled, promoted, and shaped their production, circulation, and usage.

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Cover image, from left to right:
01: A fertilizer advertisement by the largest agrochemical company in Palestine. *Al-Iqtisadiyyat al-'arabiyya*, July 15, 1935. Source: Jrayed: Arabic Newspapers of Ottoman and Mandatory Palestine, the National Library of Israel.
02: Container for "Japanese Refined Camphor," possibly 1910–1940. Source: Powerhouse Collection, CC BY-NC-ND 4.0.
03: "Pure BASF Indigo Powder" label for the Chinese market, circa 1903. Source: BASF Archive.

In telling the story of the shift from natural to synthetic, many histories of technology follow a narrative of the straightforward "replacement" of one for the other. Our case studies on synthetic dyestuffs, camphor, and fertilizers, spanning diverse temporal and spatial contexts, reveal how public discourse, industrial practices, economic and political structures, and global knowledge networks shaped this transition, highlighting the complexity of material-technological change.

## Marketing Synthetic Indigo in Germany

Synthetic coal-tar dyes produced in German factories in the late nineteenth century posed a challenge to the world's longstanding tradition of making dyes from natural resources. Although hailed as a triumph of organic chemistry and industrial innovation, these early artificial dyes faced skepticism from various quarters around their "authenticity," forcing chemical manufacturers to adapt their marketing strategies.

When the German manufacturer BASF introduced synthetic indigo in 1897, fellow German producers and chemists doubted its authenticity, suspecting it was merely a refinement of plant-based indigo. This skepticism stemmed from the difficulty of deciphering natural indigo's molecular structure, a prerequisite for synthetic production that had eluded organic chemists for over a decade. Furthermore, natural indigo planters, like the Scottish planters in Bengal, regarded synthetic dyes as inferior and "adulterated." Equally suspicious were end users, such as dyers in China, who perceived little difference in handling synthetic or natural indigo.


01 "Pure BASF Indigo Powder" label for the Chinese market, circa 1903. Source: BASF Archive.

To navigate public skepticism, BASF strategically avoided terms like "artificial" in their early marketing. Instead, they subtly promoted synthetic dyes using phrases like *echte Farben* ("real colors") or *reines Indigo* ("pure indigo"), without explicitly indicating them as artificial or natural. By carefully choosing their language and blurring the categorization of their products, chemical manufacturers attempted to address the sensitivities of different groups. Challenging the simple "replacement" narrative, then, these early controversies over synthetic indigo dye illustrate how the use of natural and synthetic was influenced by both public discourse and industrial forces.

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## Taiwan's Forests, Synthetic Camphor, and Wartime Economy


02 Container for "Japanese Refined Camphor," possibly 1910–1940. Source: Powerhouse Collection, CC BY-NC-ND 4.0.

The invention of celluloid, the world's first thermoplastic, in 1873 radically changed the industrial production of everyday goods and increased the global demand for camphor, an essential key ingredient. Camphor, distilled from camphor tree wood chips, became an important industry in East Asia, particularly in Japan. After taking control of Taiwan as a colony, following the First Sino-Japanese War in 1895, Japan tapped into Taiwan's rich camphor forests, bolstering its position as a leading camphor exporter. The rise of cinema, reliant on celluloid film, further boosted global camphor demand. Much to their dislike, the Western celluloid industry depended on the Japanese state monopoly on camphor and desperately sought alternatives to circumvent Japan's control over camphor prices.

In 1905, the Berlin pharmacy company Schering developed a synthesis process aimed at replacing Japan's natural camphor with a synthetic alternative, but initial efforts were too expensive and inefficient. Schering eventually solved this obstacle and established itself as a competitor in the international camphor market. However, the sea blockade and disrupted trade during World War I cut Germany's access to the specific types of pine whose turpentine oil was the basis for the synthesis. Only after the war, with significant capital investment, did Schering re-establish itself and synthetic camphor in the market. Rather than being a simple case of "replacement," the shift from natural to synthetic was therefore shaped over time by socio-political, economic, and diplomatic factors.

## Synthetic Fertilizers and Organic Manure in Palestine's Citrus Industry

When synthetic fertilizers arrived in British-ruled Palestine in quantities larger than ever around the 1930s, the country was in the midst of a major expansion of its citrus industry. Yet, while the price of synthetic fertilizer had dropped after WWI, and its supply was abundant, the demand for organic manure during these years intensified. Despite organic manure's diminishing availability and alarmingly increasing price during the interwar period, citrus growers insisted it was better than synthetic fertilizer for their orchards.

If the "cost-effective" logic cannot explain the growing demand for organic manure by itself, what can? Jewish citrus experts understood organic manure to be essential in returning lost plant nutrients to the soil and maintaining its physical condition. A transnational scientific fact that circulated within the global citrus knowledge community, this knowledge was used in Palestine to argue that organic manure must be used in Jewish citriculture while it