Why Paper Technologists Use the Terms “Wet End” and “Wet End Chemistry”

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Terminology plays a crucial role in shaping our understanding of a field. In this editorial, we focus on the widely used terms "wet end" and "wet end chemistry" within the realm of papermaking. By delving into historical records, our aim is to provide a deeper understanding and a clearer perspective on these terms. It is worth noting that exploring terminology can enhance comprehension and foster a more comprehensive understanding of the subject matter.

DOI: 10.15376/biores.19.1.19-22

Keywords: Terminology; Wet end; Wet end chemistry; Papermaking

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Rethinking Terminology

Terminology shapes our understanding of scientific fields, including the field of papermaking. Uncertainty surrounds the origins of terms such as “wet end” and “wet end chemistry”. To foster understanding and effective communication, it is essential to explore historical records. Aligning terminology with current knowledge and industry advancements ensures clarity and accuracy in discussions. This reevaluation can enhance our understanding and promote better communication among papermaking professionals.

Wet End

The wet end of papermaking is a vital and transformative stage within the paper manufacturing process. It encompasses a series of carefully orchestrated steps that convert a suspension of fibers into a continuous, smooth paper sheet. Interestingly, the term “wet end” emerged during a significant period of industrial evolution, as manual labor gave way to machinery as the primary means of production. The word “wet” itself implies the crucial role played by water, the universal solvent, in the wet forming process of papermaking (Fig. 1), which differs from the dry forming process.

In 1900, James Hunter Annandale (1846-1916), a citizen of the United Kingdom of Great Britain and Ireland, resided at Polton Paper Works in Polton, County of Mid-Lothian, Scotland. It was during this time that Annandale mentioned the English term “wet end” in the specification of his United States patent application (Annandale 1900), officially filed on February 17th of that same year.

The term “wet end” not only highlights the criticality of this stage in the paper manufacturing process, but also signifies the shift from labor-intensive methods to a more mechanized and efficient approach. Its mention by Annandale serves as a reminder of the

remarkable advancements achieved during this era of industrial progress. Subsequently, the term was translated into Chinese as “shī bù” or “shī duān”, and the Chinese term “shī bù” made its appearance in a Chinese paper published by Guangzhou Paper Mill's First Papermaking Workshop in 1976.

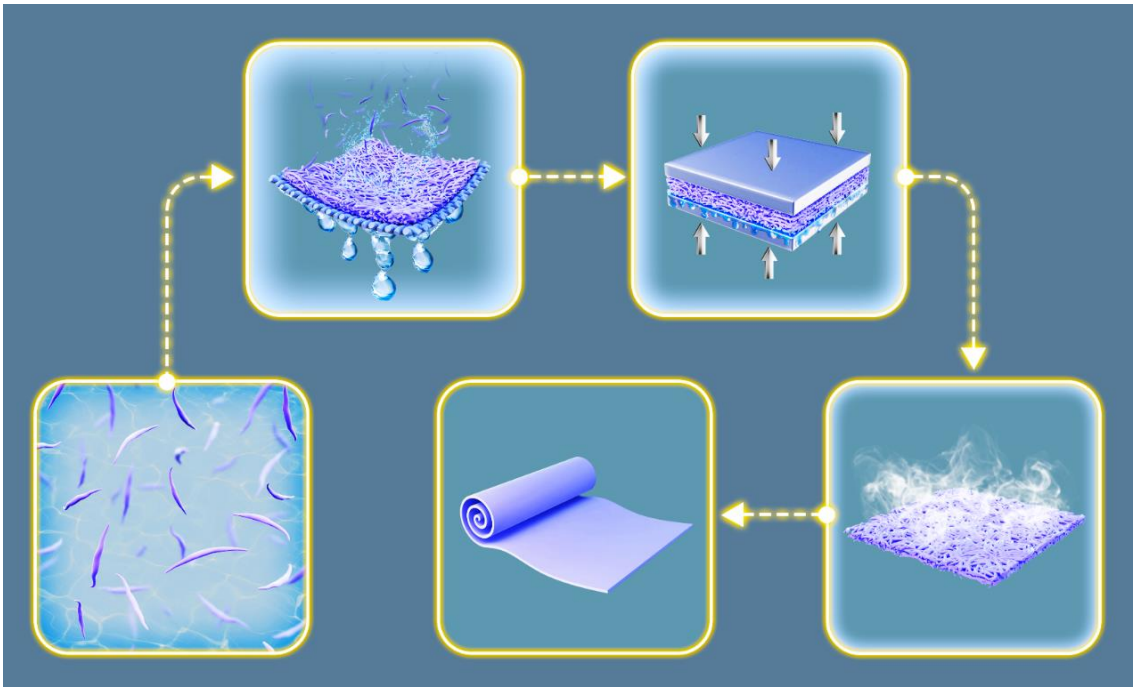

Fig. 1. Schematic illustration of wet forming process for papermaking (Shen 2023a).

Wet End Chemistry

Wet end chemistry encompasses the hidden interactions (Fig. 2) at the wet end of a paper machine system, influencing paper properties and machine runnability. Wet end chemistry impacts paper quality, efficiency, and cost-effectiveness by interacting with furnish components and utilizing colloid science. It enables customization for specific applications, meeting customer needs. Crucial for high-quality papers and market competitiveness, it reduces waste and energy consumption, promoting environmental sustainability. By leveraging colloid science, wet end chemists control particle dispersion, flocculation, and retention for optimal paper formation. Through optimized chemical processes, it achieves desired characteristics and improves paper properties. Wet end chemistry plays a vital role in driving efficient and high-quality paper production.

An early example of wet end chemistry research includes coflocculation studies examining the interaction between filler particles and fibers (Haslam and Steele 1936), which also discussed the role of chemical additives such as alum and starch. The term “wet end chemistry” was first mentioned in a conference paper by Edwin Terrington Sortwell (1934-2022) from the Nalco Chemical Company of the United States. The presentation associated with this conference paper took place at a joint meeting of the Scottish Division with the North East Scotland Discussion Group on October 12, 1971. The objective of Sortwell’s work, as stated in the conference paper, was to demonstrate the interconnectedness of wet end problems and promote a comprehensive understanding of wet end chemistry (Sortwell 1972).

In 1992, William E. Scott (widely known as Bill Scott) (1940-2022) from Miami University, United States, authored a book titled *Wet End Chemistry: An Introduction* (Scott 1992). An updated version of the book, titled *Principles of Wet End Chemistry* (Scott 1996), was published in 1996. These publications paved the way for further research in the field, leading to the emergence of other books with titles such as *Advances in Papermaking Wet End Chemistry Application Technologies* (Hubbe and Rosencrance 2018), *Papermaking Wet End Chemistry* (Liu and Qiu 2006; Liu 2010), *Applications of Wet-end Paper Chemistry* (Thorn and Au 2009), and *Papermaking Wet End Chemistry Principles and Applications* (Zhang 1998). These contributions, along with decades of research activities, have significantly contributed to the ever-enhancing understanding of the fundamentals of wet end and wet end chemistry, driving technological advancements in papermaking innovation.

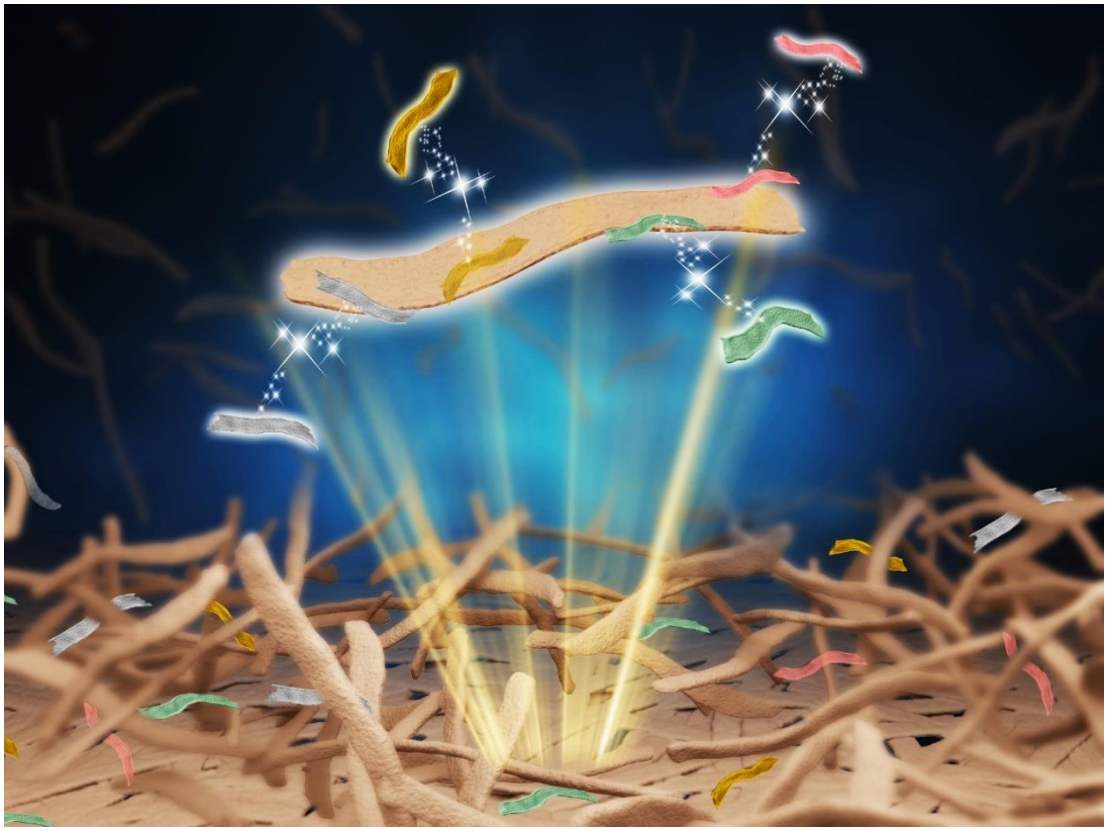

Fig. 2. Schematic illustration of wet end and its interactions (Shen 2023b)

Terminology and the Future

Though some papermaking terms such as "wet end" have very deep roots, modern media has accelerated the pace at which new terms can rise to prominence in an industry such as papermaking. For instance, academic terms such as "nanocellulose" and "microfibrillated cellulose" are now commonly included in conference presentations attended by today's papermaking scholars. Other terms can enter common usage in paper mills by way of advertising. For example, the colorful term "anionic trash" can be traced to promotional efforts by John Penniman, who was marketing equipment and processes (Penniman 1988). Terminology can be fluid, and it continues to evolve. No one can

possibly predict what new terms will be heard in paper mills in the future. But one thing is for sure: Papermakers still will be able to communicate readily with each other. Some visitors to paper mills, on the other hand, may need to ask sometimes what the mill people meant.

ACKNOWLEDGMENT

Jing Shen would like to acknowledge the support by the Fundamental Research Funds for Central Universities of China (2572021CG04), the Natural Science Foundation of China (218708046), the Program for New Century Excellent Talents in University (NCET-12-0811), the Longjiang Scholars Program (Q201809), and the Heilongjiang Natural Science Foundation for Outstanding Young Scholars (JQ2023C004).

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