

Studies in the Art of Home Brewing

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Abstract

I consider the problem of brewing under domestic conditions. These novel findings should improve brewing experiences for many enthusiasts.

Dedication and acknowledgements

This work is dedicated to those who seek perfection in the art of home-brewing. I would like to thank all those who have helped me in the production and consumption of my own beer over the years. I am particularly indebted to

Author's declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: DATE:.....

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Acronyms

SIAM Society for Industrial and Applied Mathematics. 3

Chapter 1

Introduction

The outline of this thesis is as follows. Chapter 2 is a book review project I downloaded from the internet by William Laufer. The text is pretty much cut-and-pasted directly. There are no more chapters.

Chapter 2

Principles of Brewing Science

Making sugar water. The process of beer making is most basically stated as making sugar water. The elemental process of treating grains to convert starches into fermentable sugars hasn't changed in the nearly 10,000 years (6,000 years for the first documented reference to brewers) since the first brews were conceived by the Sumerians. It is the process of making grains that would grow in poor soil with little rain water into edible sustenance. Some historians even credit the discovery of beer as the motivation of early peoples to abandon nomadic lifestyles and begin agriculture and civilization.

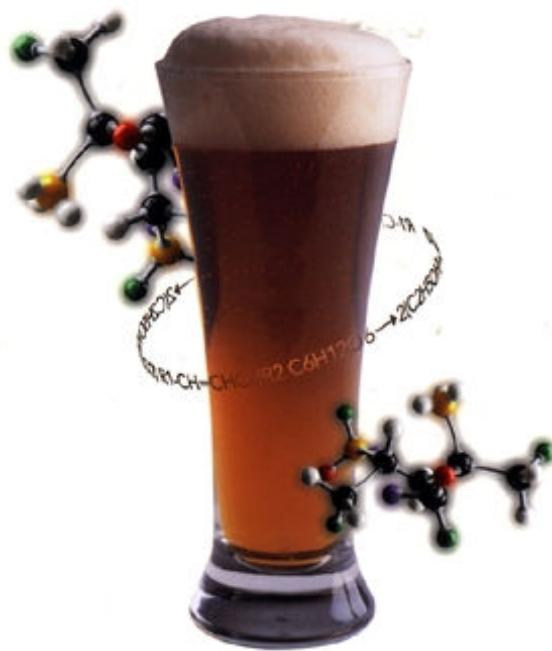
While nearly anyone with a little knowledge can mash, boil, and ferment their way to beer, to actually produce a product you wouldn't have to drink through a straw to avoid the bitter inedible bits and would enjoy drinking for reasons other than survival or intoxication requires skill, knowledge, and a deep understanding of chemistry. The modern process of producing high quality beer from beginning to end requires the careful manipulation of multiple chemical and biochemical processes. These processes are explored in detail within this book.

The author of *Principles of Brewing Science* [Fix99], George Fix, was a published author not only of several brewing science books but also of many mathematics articles. He held his PhD from Harvard and was chairman of mathematics at Carnegie Mellon University, the University of Texas at Arlington, and Clemson University throughout his distinguished career. He maintained a second career following his passion for home brewing as well as mathematics. According to his obituary on the Society for Industrial and Applied Mathematics (SIAM) website

His own home brews won countless regional and national sanctioned competitions, and he was named Homebrewer of the Year in 1981 by the American Homebrewers Association (AHA). He wrote

Principles of Brewing Science

A Study of Serious Brewing Issues
SECOND EDITION



GEORGE FIX, Ph.D

Figure 2.1: Cover of the book

three books on beer, two with his wife, Laurie, and the other a scientific treatise titled *Principles of Brewing Science*, which has gone through two editions and which is a standard reference among amateur and especially professional brewers.

This book (see figure 2.1 for cover) is detailed, thorough, and written as you would expect from a man of his academic background. It is clear and logically laid out; the chapters follow the major steps all brewers amateur and professional alike follow in development of a brew. It is written more akin to a textbook than to a normal homebrew book. It is packed with structures of proteins, starches, and sugars, enzymatic reductions of starches and sugars to simple sugars, yeast and bacterial metabolisms, and finally mechanisms for oxidation and beer stabilization.

The presentation is in-depth and concise making it so packed with information it became a difficult read. The plethora of structures, tables, and figures was helpful but I still found myself reading sections multiple times and still struggling to fully digest the chemistry and its connection in the brewing process. Much of the discussion in the book of the enzymatic treatment of sugars and starches didn't become clear until late in the Chemistry 503 course.

The book assumes a working knowledge of the brewing process and a fairly intimate knowledge of chemistry. It is not for the amateur homebrewer looking for another how-to book full of tips and recipes. For those that are willing to struggle through the chemistry it will reward them with a true understanding of the brewing process and more complete control of their product. Whilst most homebrew books give you cookie cutter step by step instructions, this book will allow you to truly craft your own quality beers.

As I read the book it struck me that this would be an intriguing basis of a chemistry elective course for chemistry majors at the undergraduate level. This book will definitely remain a reference in my brewing library, but as a book for someone unfamiliar or uncertain of either the brewing process or general and organic chemistry I would suggest starting with *Brew Chem 101: the Basics of Homebrewing Chemistry* by Lee Janson [Jan96].

Appendices

Appendix A

Brewing Equipment

A.1 Essential equipment

This appendix describes basic brewing equipment. All brewers will need the equipment listed in table A.1

Item	Price
Big plastic spoon	£1.50
5 Gallon tub	£5.00
Thermometer	£2.00
Siphon tube	£1.00
Plastic/glass bottles or keg	variable

Table A.1: List of essential equipment and prices

Bibliography

- [Fix99] George Fix. *Principles of Brewing Science: A Study of Serious Brewing Issues*. Brewers Publications, 2nd edition, 1999.
- [Jan96] Lee W Janson. *Brew Chem 101: The basics of Homebrewing Chemistry*. Storey Publishing, 1996.