

# **Processing of various adjuncts in beer production**

**Raw grain adjuncts – Sugars and sugar syrups –  
Malt substitutes**

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## Abbreviations

AAL	Apparent attenuation limit
ADF	Apparent degree of fermentation
as is	air-dry condition
BC	Before Christ
CCV	Cylindroconical vessel
cG2	Maltose concentration
DE	Dextrose equivalent
DP	Diastatic power
ED	Extract difference (Fine/coarse)
E <sub>452</sub>	Extinction value in a 1 cm cuvette at 452 nm
d.m.	In dry matter
FAN	Free alpha-amino nitrogen
FAO/WHO	Food and Agriculture Organization of the World Health Organization
FCC	Food chemicals codex
F <sub>pase</sub>	Filter paper saccharifying activity
GDR	German Democratic Republic (1949 - 1990)
GT	Gelatinization temperature
ISPP	Industrial scale pilot plant
IU	International enzyme units
JECFA	Joint FAO/WHO Expert Committee on Food Additives
M	Mole mass in Dalton (Da)
MF	Malt fraction
MEV	Malt equivalent value
OG	Original gravity
PW	Pitching wort
RBA	Raw barley adjuncts
RDF	Real degree of fermentation
TU	Tyrosine units
U	Units
v <sub>max</sub>	Maximum rate of reaction
YB	Young beer
°WK	Degrees Windisch-Kolbach

### Abbreviations for statistical analyses

R <sup>2</sup>	Coefficient of determination
multiple R <sup>2</sup>	Coefficient of determination for multiple regression and correlation analysis
n	Number of test series
*	Result with 95 % confidence limits
**	Result with 99 % confidence limits
***	Result with 99.9 % confidence limits



## Preface

With the title "Raw Materials, Technologies and Techniques for the Processing of Various Adjuncts in Beer Production", the authors wish to present a short history of the use of raw grain adjuncts and inform about the present situation.

Alongside an explanation of the important terms, the focus is on the main adjuncts corn (maize), rice and barley and the peculiarities associated with their processing but also on millet/sorghum, wheat, rye, oats, triticale, manioc as well as starch syrups and other sugar products. The use of whey and potatoes is also dealt with.

The enzymes relevant for the digestion of adjuncts are outlined and the handling of enzyme preparations explained.

The technical equipment for the preparation and processing of the adjuncts, especially the mechanical crushing and grinding techniques, are presented.

Key topics in the text are, above all, the mashing process and suggestions for wort production using raw grain adjuncts in the brewery. Emphasis is given to the processing of raw barley.

Finally, quality aspects of the beers and economic considerations of adjunct use are discussed.

The results presented are based on the long term experiences of the authors with the use of adjuncts in the brewing industry of the former GDR and their accompanying scientific support.

The accumulated knowledge could also be of assistance in the future to secure the extract base for the international brewing industry.

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