



ROASTED PRODUCTS

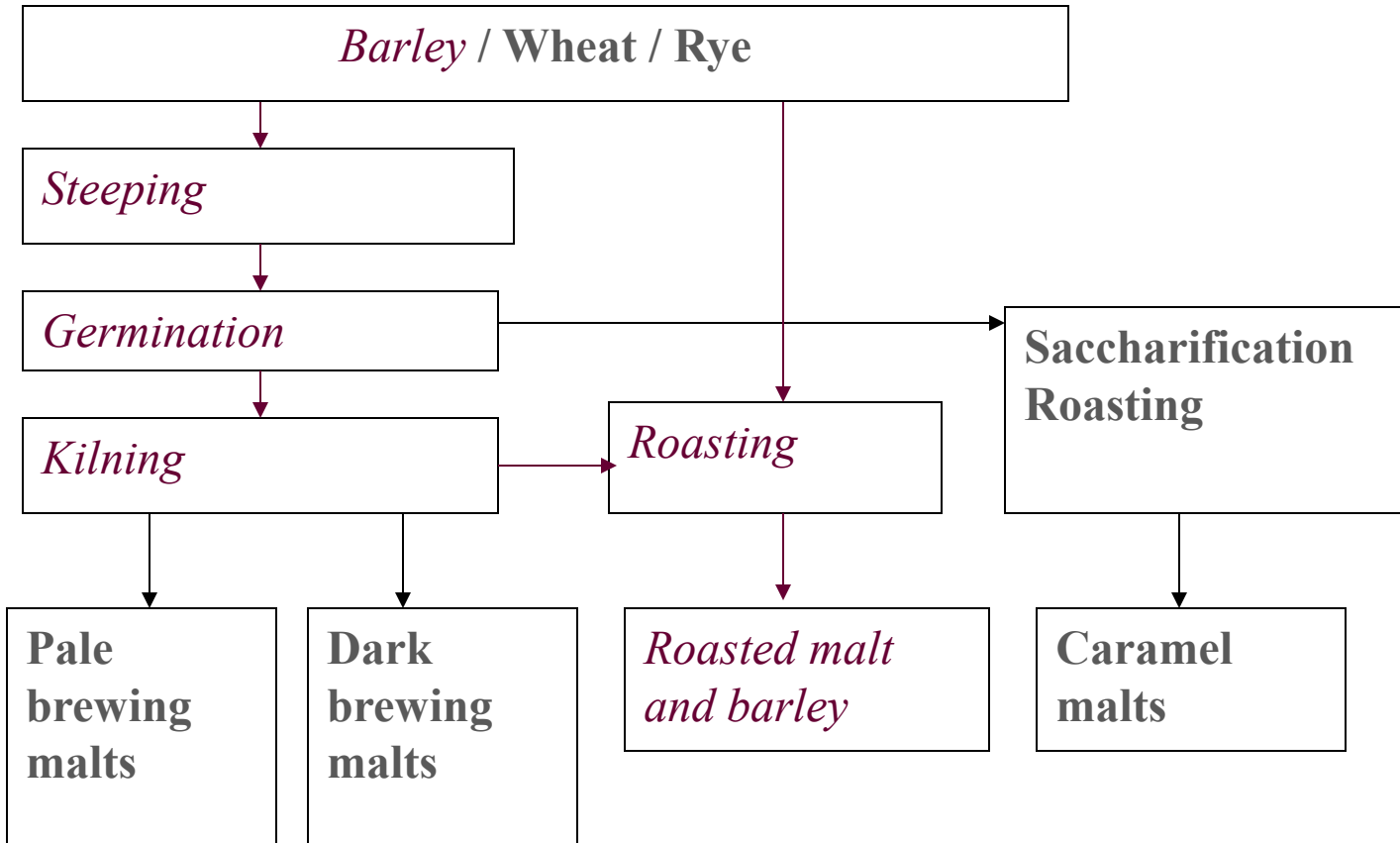
How to brew unique lager beer?

- By using different kind of malts you will find a solution to
 - colour adjustment
 - preferred flavour profiles with good stability
 - fast turn-around times
 - improved foam properties
 - good colloidal stability

Viking Malt malt types

- pale brewing malts
- dark brewing malts
- pale caramel malts
- dark caramel malts
- **roasted products**
- other malts like wheat malt

Production of different malts



Product information

Typical malt analyses:

| product | extract % | moisture % | colour | pH | rdf |
|----------------|-----------|------------|--------|------|-----|
| Black malt | > 65 | < 1,0 | 1500 | 5,30 | 17 |
| Roasted barley | > 65 | < 1,0 | 1500 | 5,30 | 12 |

High gravity wort results:

| Analysis | 100 % pilsner malt | 5 % roasted barley | 5 % black malt |
|-----------------|--------------------|--------------------|----------------|
| colour | 6,5 | 143 | 138 |
| extract | 16,2 | 16,0 | 16,1 |
| filtrate 15 min | 84 | 37 | 35 |
| pH | 5,54 | 5,45 | 5,45 |

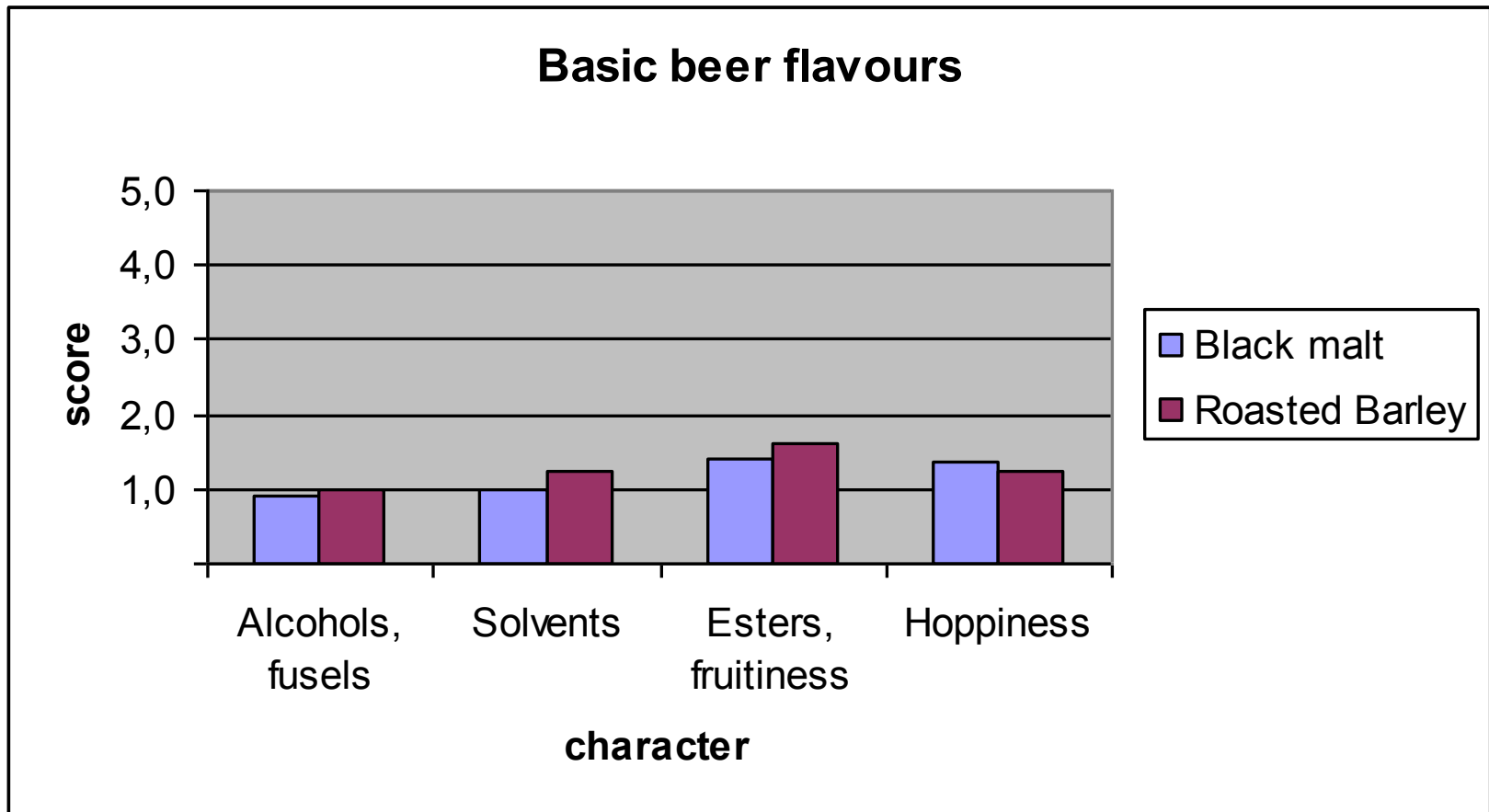
Trial brews

- two beers were brewed to evaluate the effects of roasted products on brewing behaviour and product quality
 - 3 % Roasted Barley + 97 % Pilsner Malt
 - 3 % Black malt + 97 % Pilsner Malt
- special emphasize was put on
 - process beaviour
 - flavour evaluation
 - colour
- could real dark lager be brewed only with two malts of completely different characters?

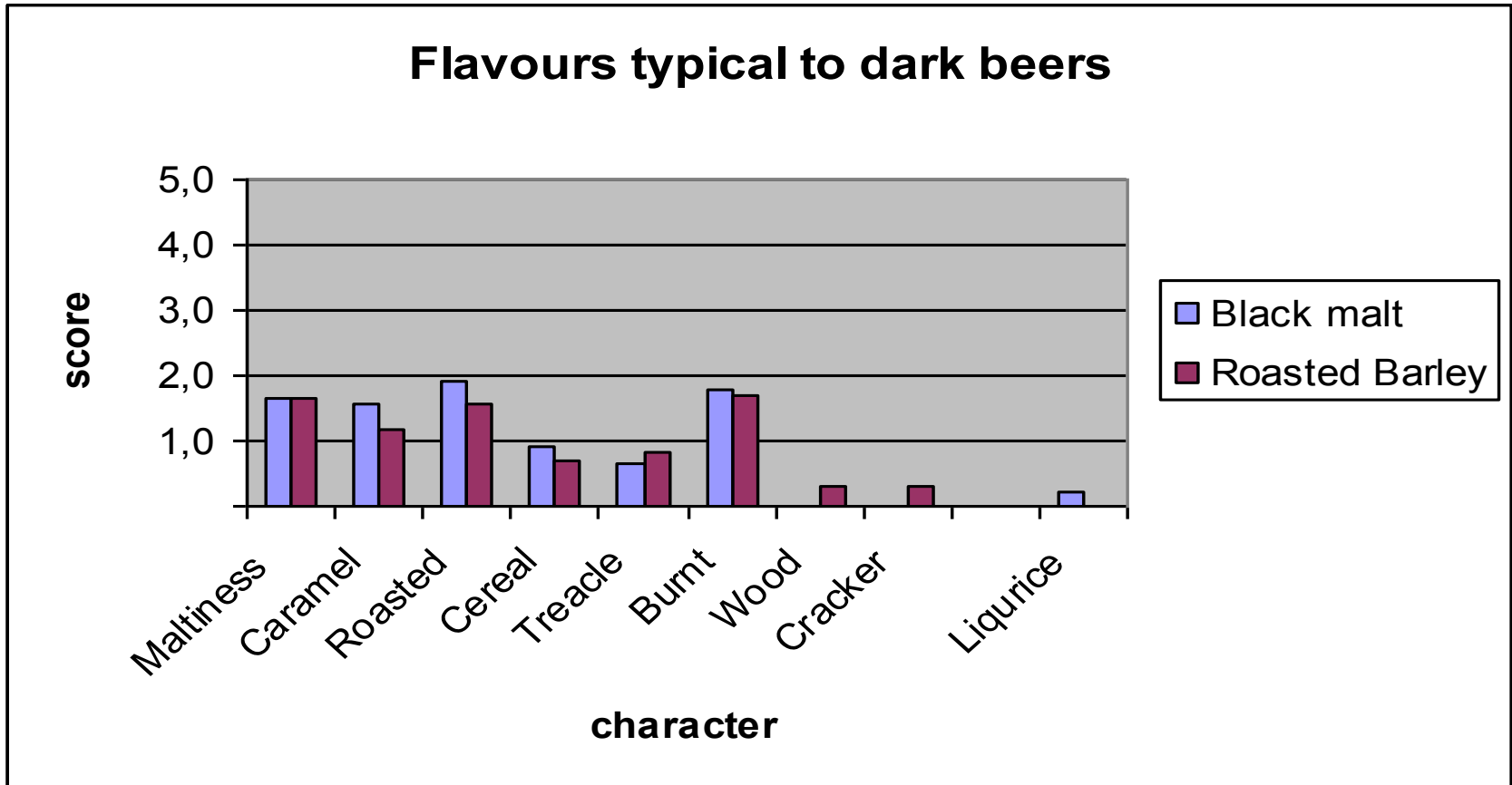
Flavour

- contribute specially to the flavours that are typical for dark beers
- trial beers with 3 % portion of roasted products gave a smooth dark lager with good drinkability
- differences between beer flavours were minor
 - beer with roasted barley was slightly richer in flavour
- effects of accelerated aging on beers were also minor

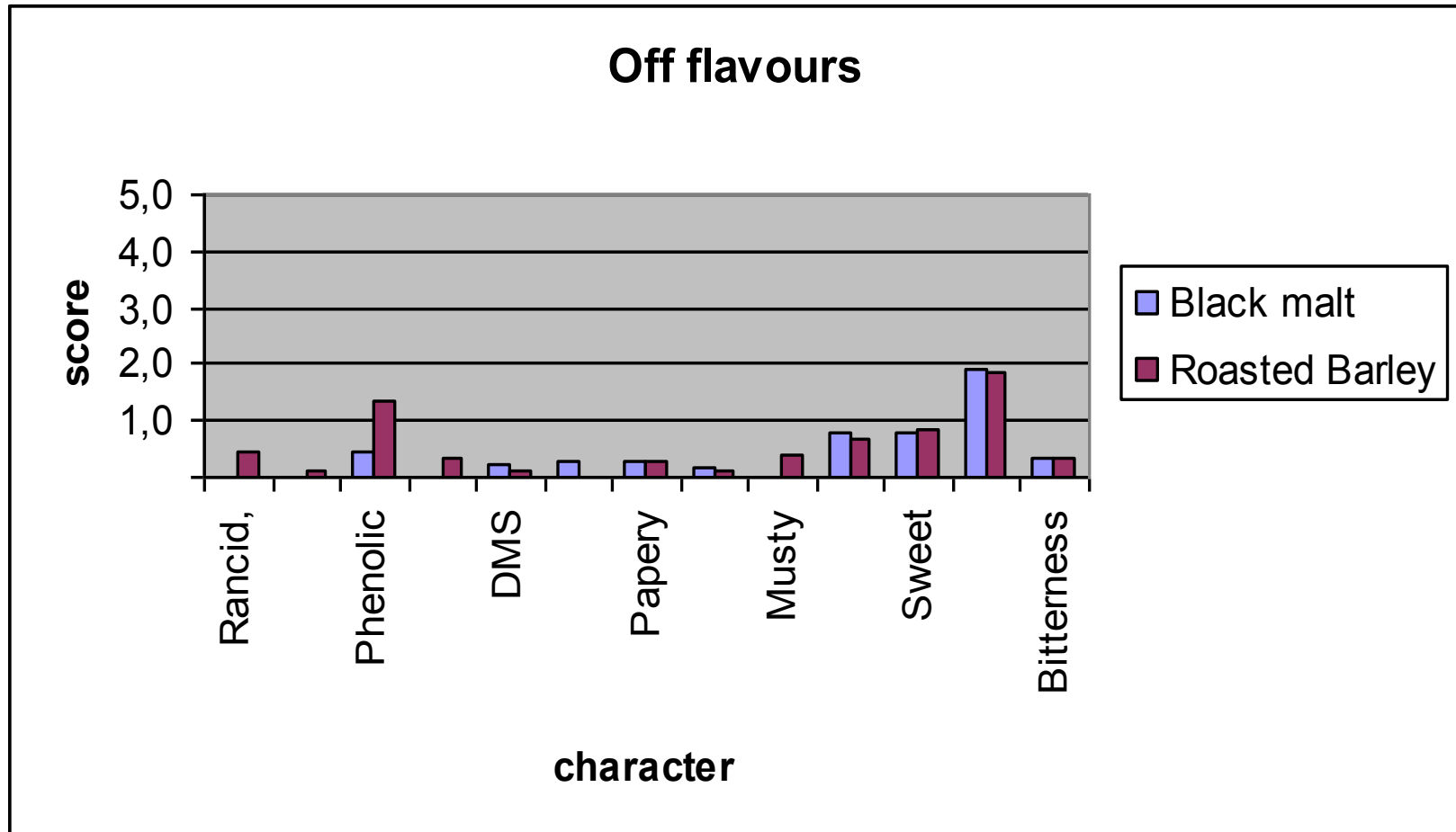
Flavour, fresh beers



Flavour, fresh beers

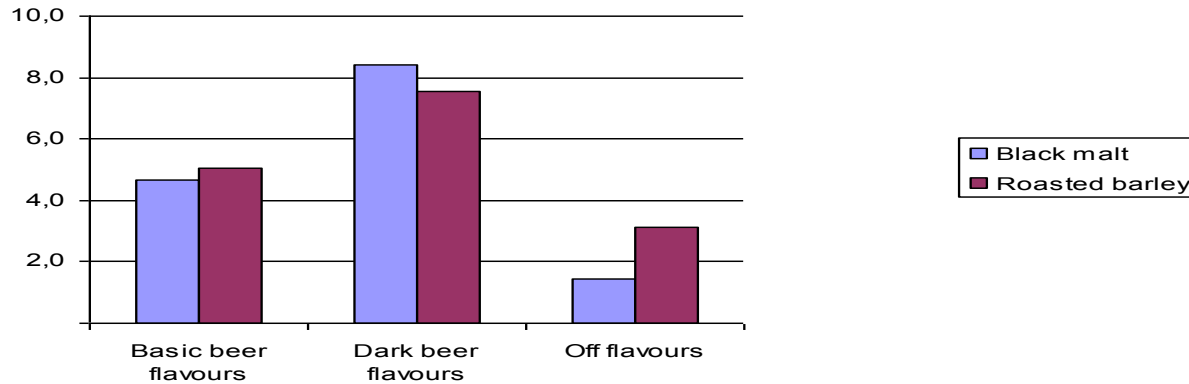


Flavour, fresh beers

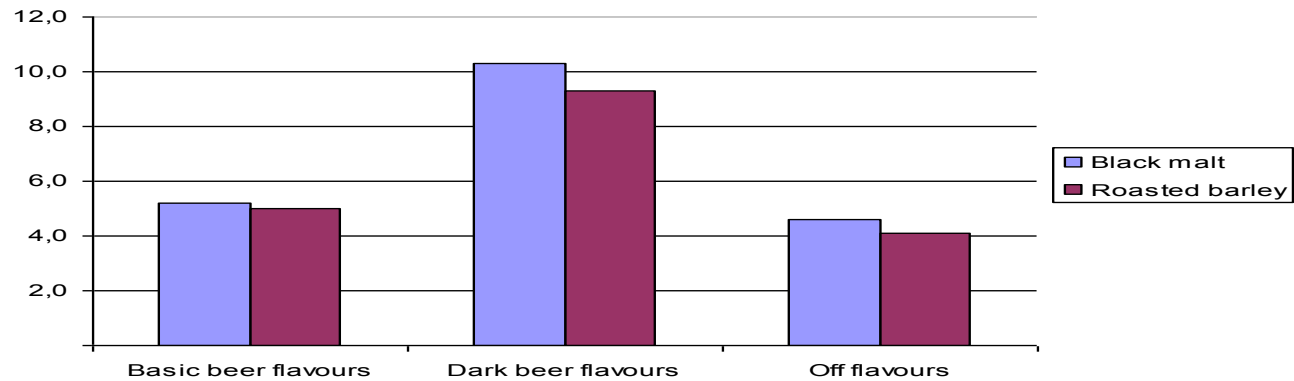


Effect of aging on beer flavour

Flavour evaluations as fresh



Flavour estimation as aged



Colour of beers

- wort colours were similar (50 EBC)
 - no colour increase during the boil
- after fermentation colours were
 - 45 EBC (Roasted Barley) => 10 % loss
 - 37 EBC (Black Malt) => 30 % loss
- no differences at colour hues

Beer analysis

| Analysis | unit | Black Malt | Roasted Barley |
|--------------------------|--------|------------|----------------|
| Original gravity | mas. % | 10,9 | 11,9 |
| Alcohol | vol. % | 4,81 | 5,16 |
| Residual extract, app. | p- % | 1,85 | 2,2 |
| Apparent degree of ferm. | % | 83 | 81,5 |
| Bitterness | EBU | 17 | 15 |
| Colour | EBC | 37 | 45 |
| pH | | 4,5 | 4,5 |

| Analysis | unit | Black Malt | Roasted Barley |
|-------------------------|------|------------|----------------|
| Foam stability | s | 245 | 260 |
| Haze | FU | 0,5 | 0,6 |
| Haze test (7 d, 40 C) | FU | 0,6 | 0,4 |
| Taste, fresh | | 4 (3,8) | 4 (3,5) |
| Taste, aged (7 d, 40 C) | | 4 (3,5) | 3 (3,2) |

Main findings from trial brews

- brewhouse behaviour using 3 % roasted products in a grist was considered normal in this trial
- amount of fermentable sugars is low in both products
 - Black Malt has a higher attenuation limit than Roasted Barley
- the colouring value was better for Roasted Barley
- the beer flavours were not so typical for such dark beers
- both colloidal and flavour stability were found to be good (one week at 40 °C- test)

Summary

- natural way of adjusting colour
- colour to flavour ratio is high
- roasted products are safe products
- economically reasonable way of brewing real dark lager