Whey valorization for new value added product development

Latvijas Lauksaimniecības universitāte

LATVI DAN AGRO
Izvēlies Latvijā audzēto!

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JAUNPILS PIENOTAVA 1912
JAUNPILS

LLU

A/S Jaunpils pienotava

Z/S Ruķi, Z/S Talči , SIA Latvia Dan Agro

BioEcUz Forum

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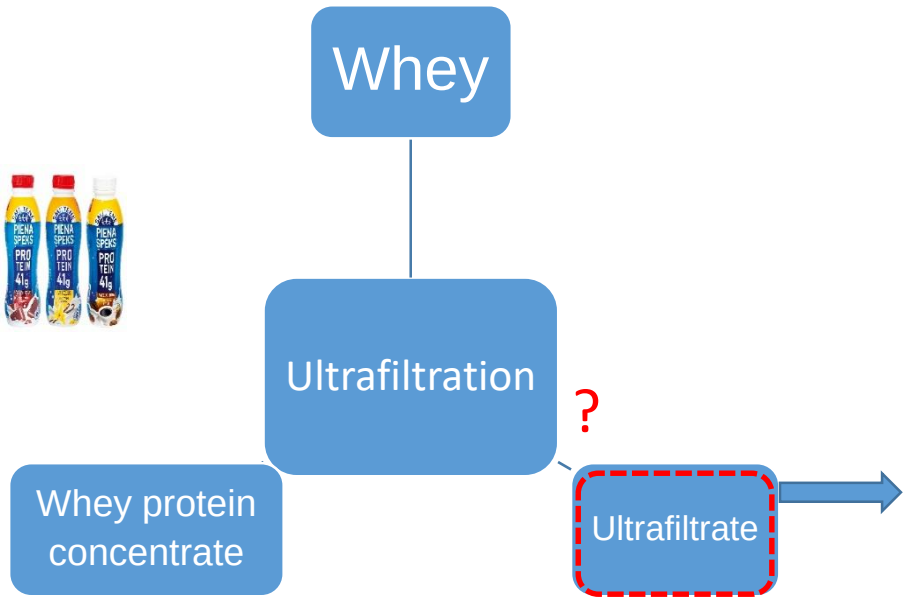
Whey chemical composition

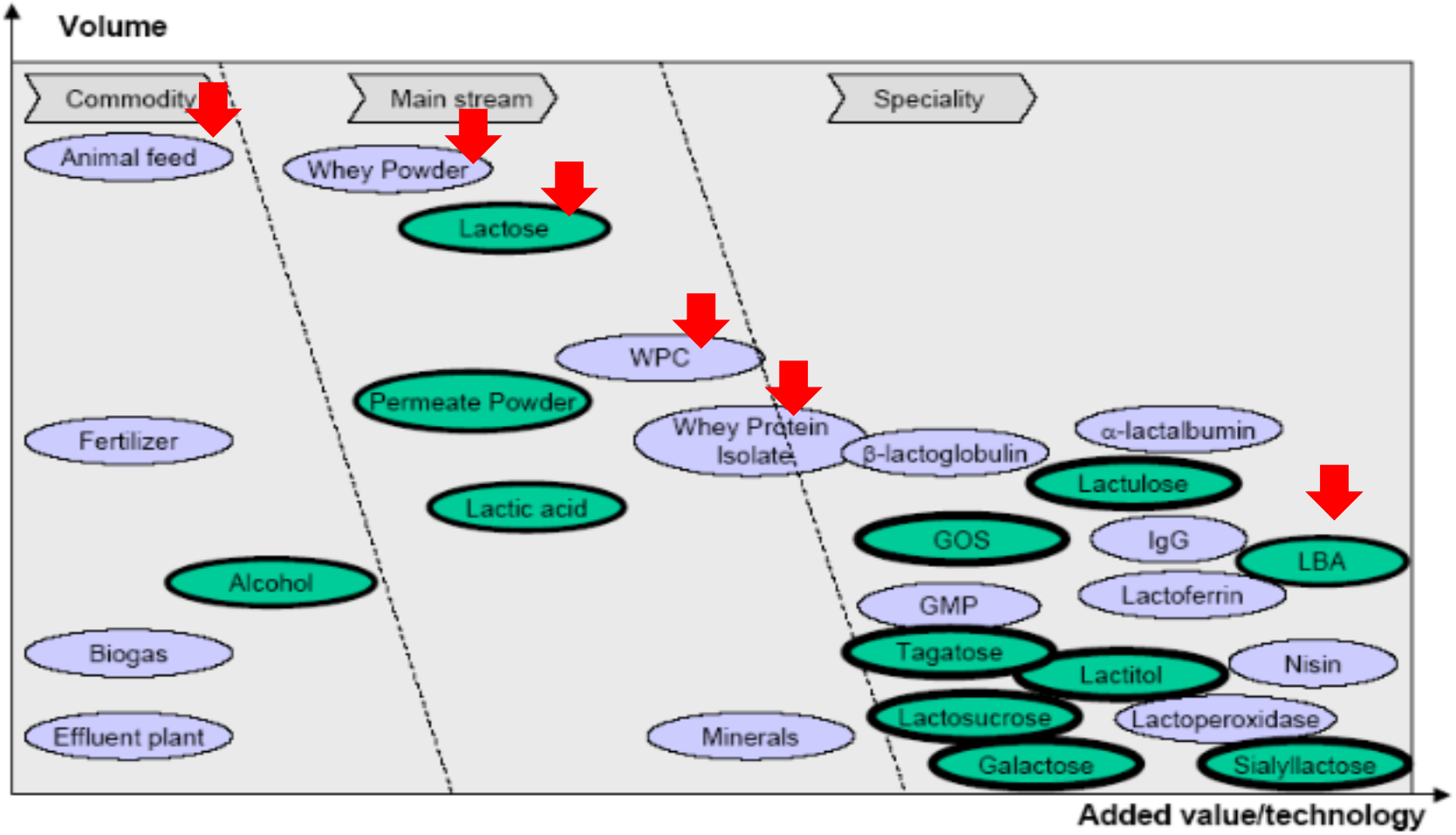


Ultrafiltrate of whey

Content	Sweet	Acid
Solids, %	5.38	5.92
Fat %	0.01	0.02
Protein, %	0.19	0.39
Lactose, %	**4.69**	**4.70**
Minerals , %	0.51	0.80
pH	6.10	4.53

Avots: Milk processing companies, 2020

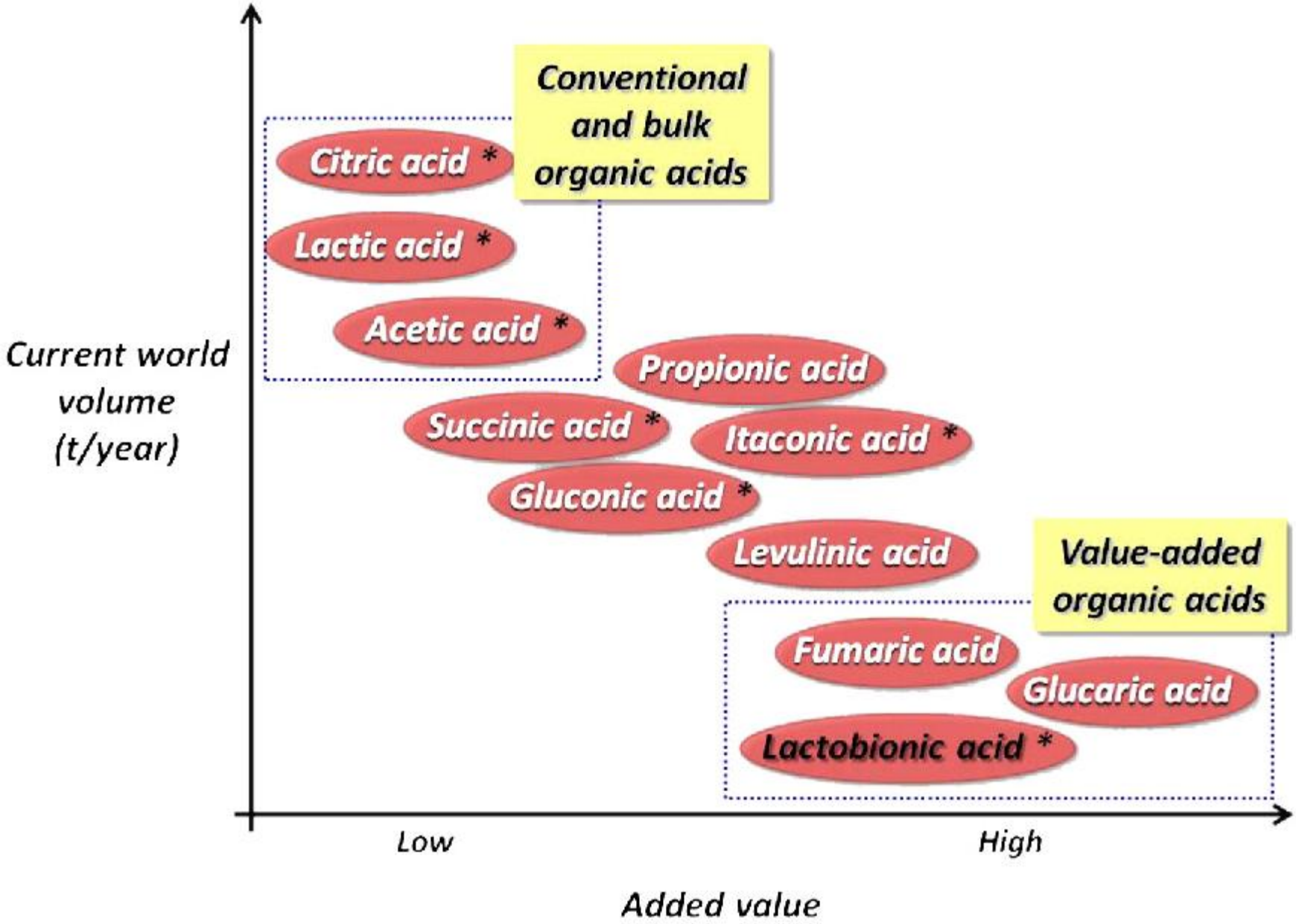
Whey processing possibilities



Bio-production of lactobionic acid: Current status, applications and future prospects, 2013

Why fermentation of whey?

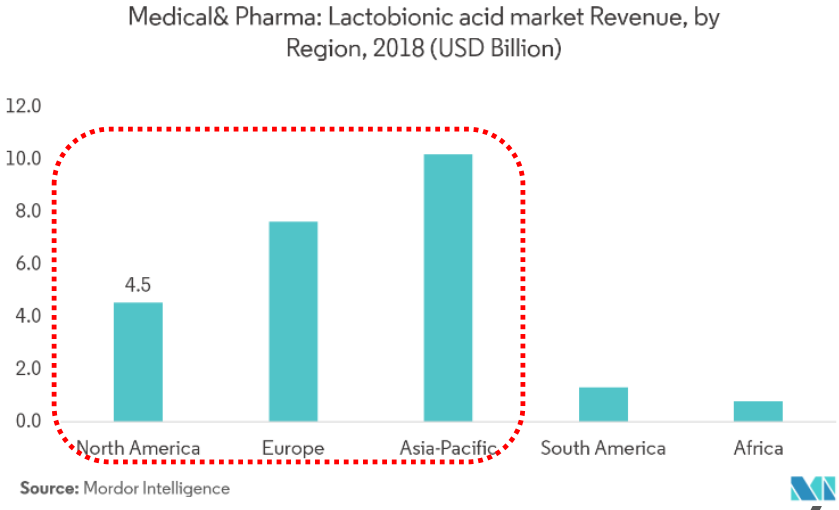
- Other methods are not so perspective, low pH and short shelf-life;
- Main component of whey is lactose – is interesting object for new value – added product development;
- Fermented whey positively influence microbiota of animals;
- For fermentation mostly lactic acid, yeast and bifidobacteria are used;
- For fermentation other microorganisms, as *Pseudomonas, for obtaining valued added feed and food production could be used*!



Bio-production of lactobionic acid: Current status, applications and future prospects, 2013

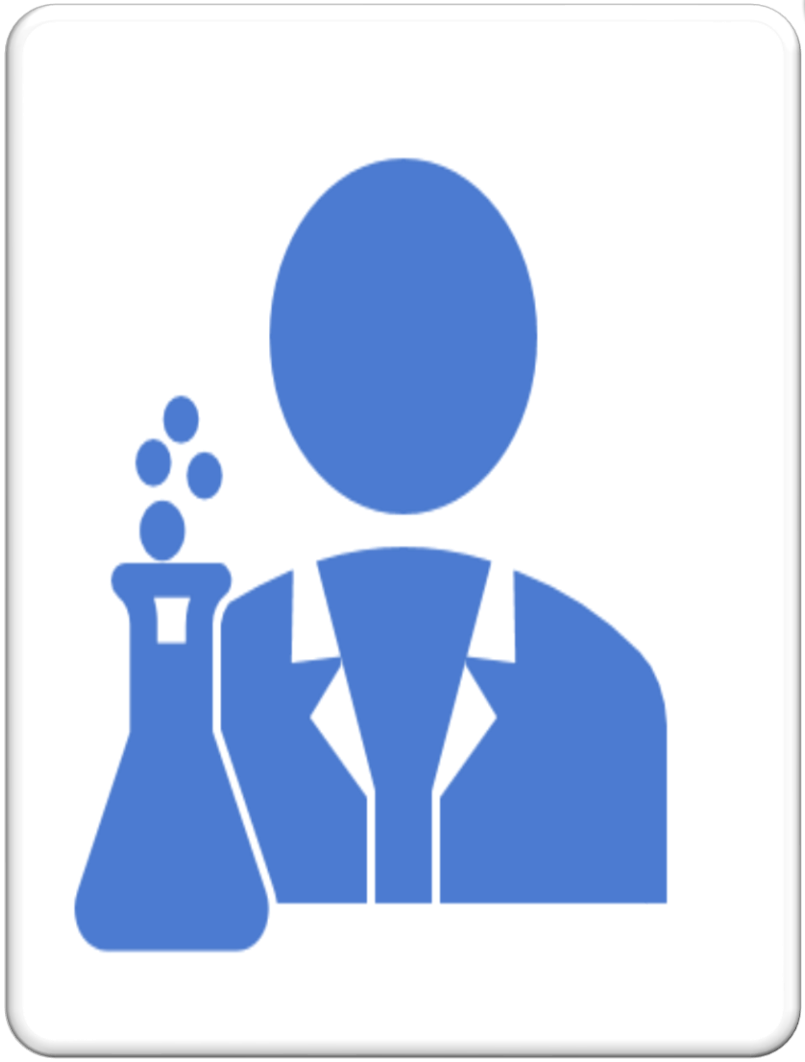
LBS application

Food	Agriculture
Cosmetic	Pharmacy



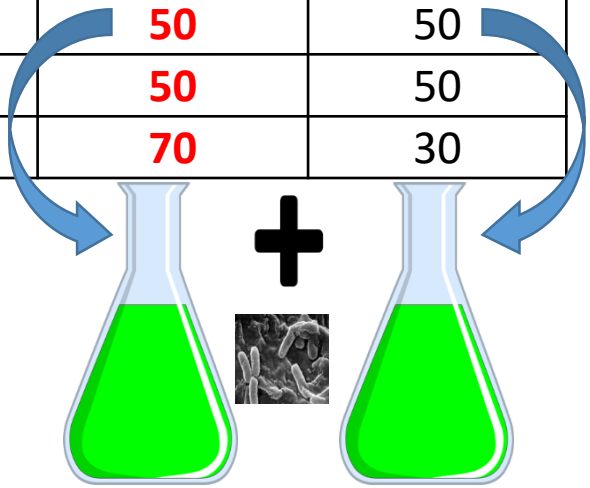
https://www.mordorintelligence.com/industry-reports/lactobionic-acid-market

Research results

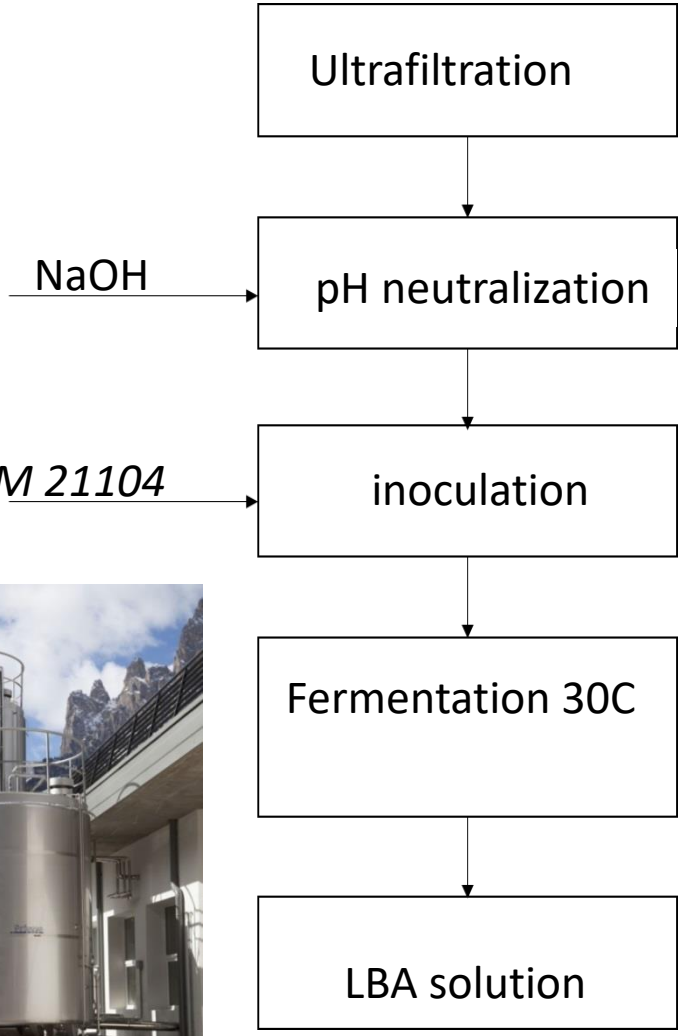


LBS production

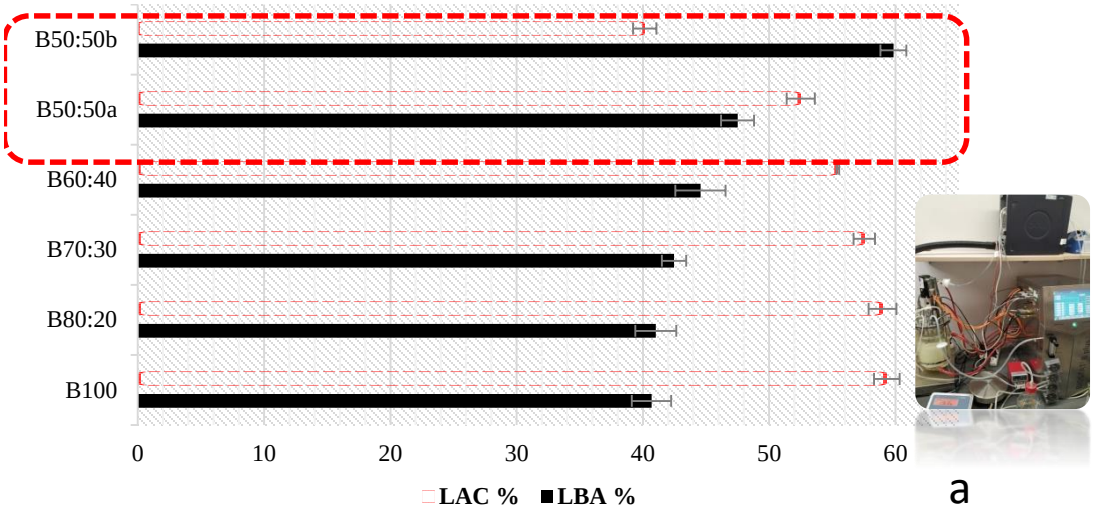
Flask		
Whey	acid%	sweet%
F**100**	**100**	-
F**50**:50	**50**	50
F**60**:40	**60**	40
F**70**:30	**70**	30
F**80**:20	**80**	20
Bioreactor		
B100	-	100
B**100**	**100**	-
B**100**^{p}	**100**	-
B**50**:50$_{a}$	**50**	50
B**50**:50$_{b}$	**50**	50
B**70**:30	**70**	30



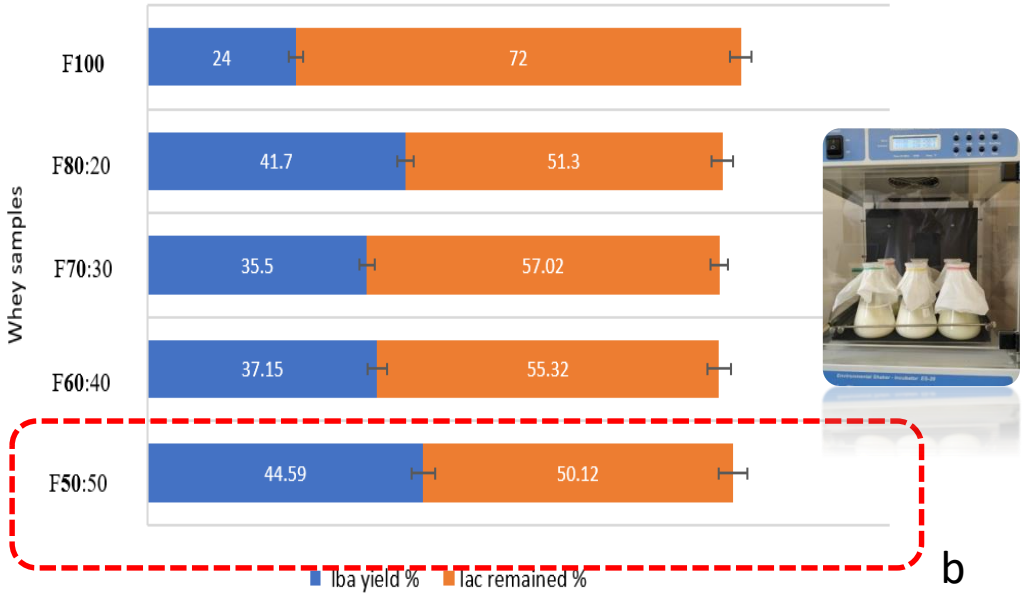
Pseudomonas taetrolens DSM 21104



LBS yield



a



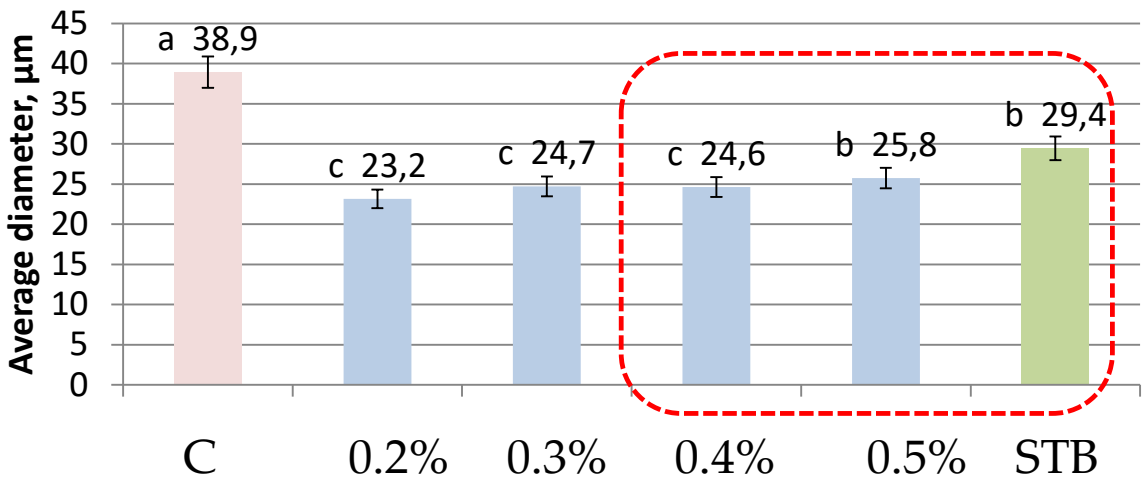
b

LBS yield during laboratory experiment: a. bioreactor, b flask

LBS yield,
A/S Jaunpils pienotava

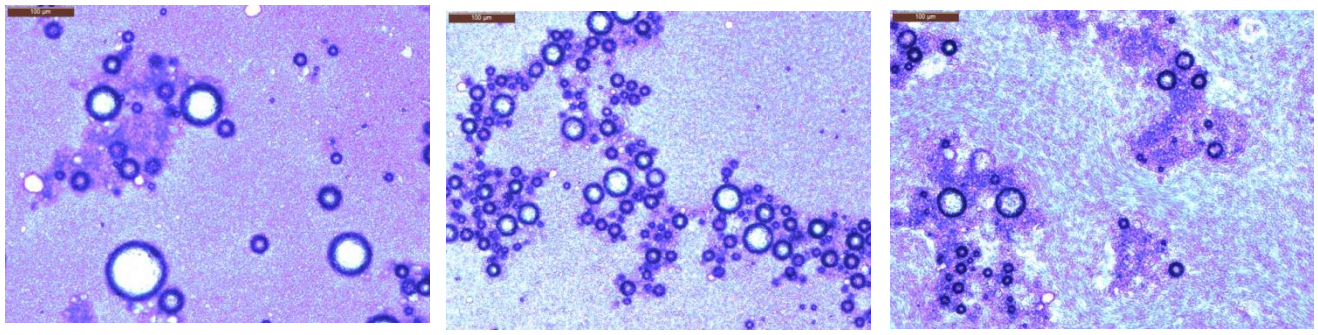
pH	Lactose	LBS	
	content, %	content, %	yield, %
5.37	4,6	**32,03**	69,64
5.40	4,6	**25,07**	54,51
5.96	5,17	**42,82**	82,82
4.91	4,70	2,42	5,14
4.24	5,91	3,04	5,14
4.66	9,81	9,60	9,79
4.55	10	10,79	10,79
4.46	**18,04**	15	**8,31**
4.56	**18,06**	7,27	**4,03**

Results, ice-cream quality



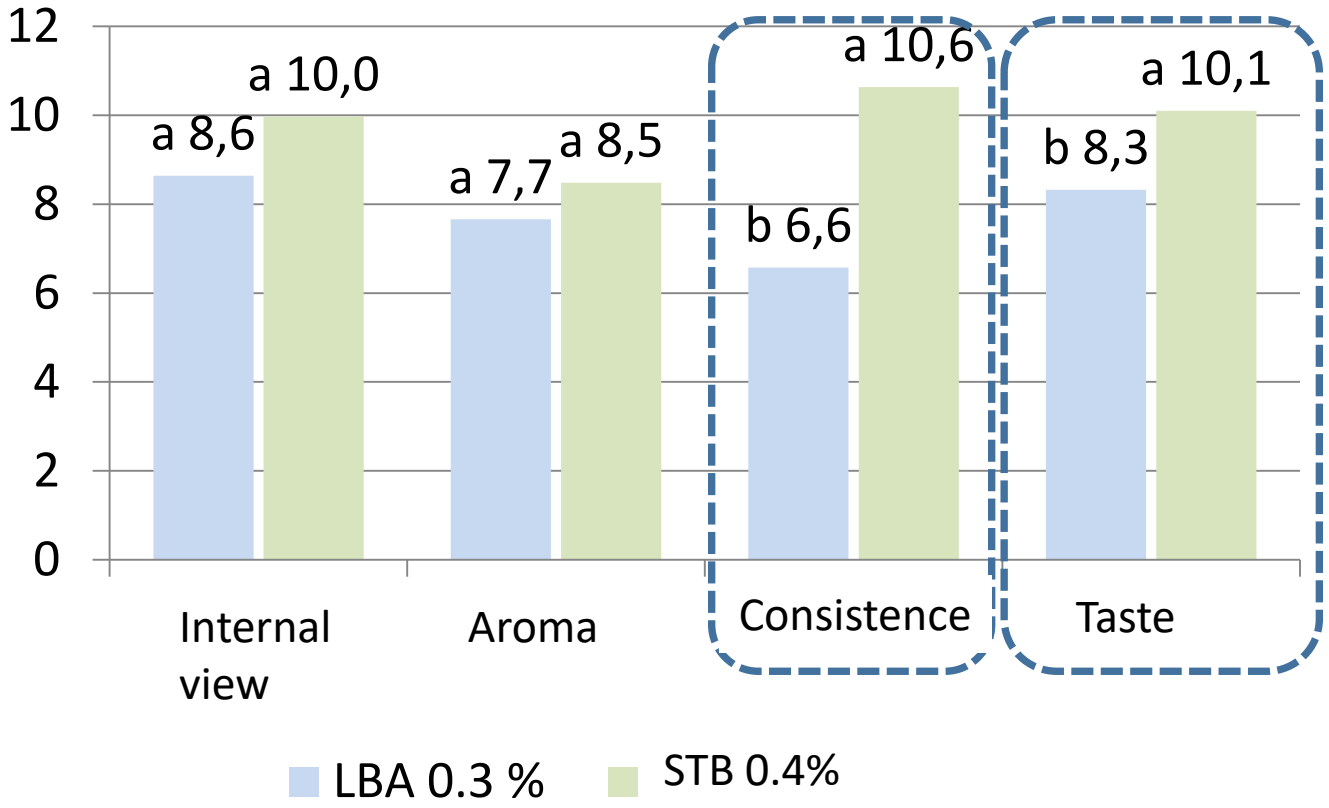
Sample	Overrun, %
C	25.93a
0.2% LBA	55.80c
0.3% LBA	59.76cd
0.4% LBA	63.90d
0.5% LBA	42.56b
0.4% STB	62.92d

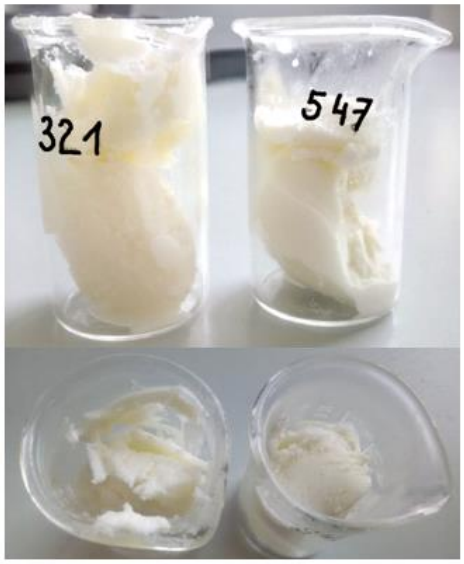
✓ 19.9 – 38.2 µm



Air bubble diameter

Ice cream, sensory evaluation



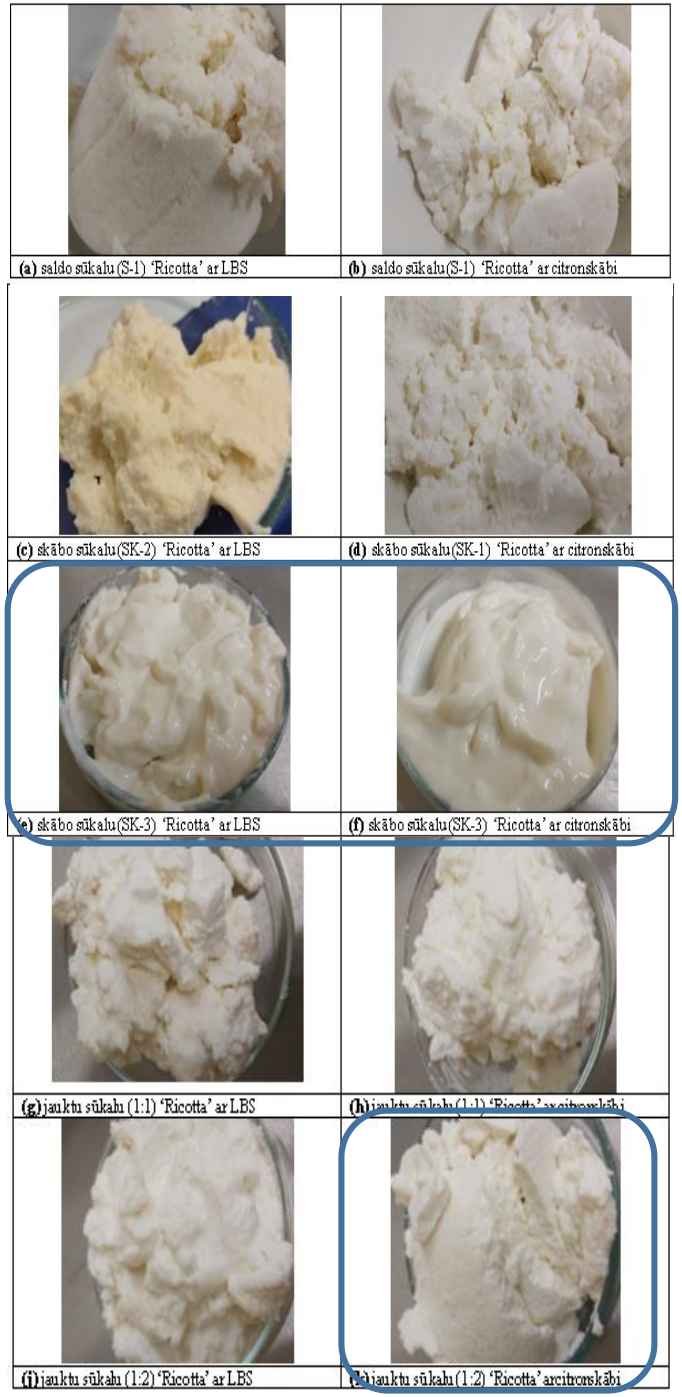


LBA 0.3% S 0.4%

Chemical composition of 'Ricotta'

Whey	Acid	moisture, %	protein, %	fat, %
sweet	S-1-C	76.02±3.80	11.45^{c}±0.57	$3.50±0.18^{b}$
	S-1-L	78.64±3.93	11.54^{c}±0.57	$4.00±0.20^{a}$
acid	SK-1-C	76.40±3.82	14.07^{b}±0.70	$4.00±0.20^{a}$
	SK-2-L	77.97±3.90	6.81^{d}±0.34	<0.05
	SK-3-C	**81.00±4.05**	7.72^{d}±0.39	<0.05
	SK-3-L	**81.50±4.08**	7.54^{d}±0.38	<0.05
mix	J-1-C	80.05±4.00	**17.13^{a} ± 0.79**	<0.05
	J-1-L	79.81±3.99	**16.28^{a} ± 0.41**	<0.05
	J-2-C	**82.51±4.13**	13.21^{b} ± 0.61	<0.05
	J-2-L	80.63±4.03	**15.97^{a} ± 0.29**	<0.05

a, b, c – significant difference($p<0.05$)



Lactose concentration in whey after production of 'Ricotta', %

Whey/ acid	Sweet	Acid			Mix	
		SK-1	SK-2	SK-3	J-1	J-2
Citric acid	90.02±0.50	-	100±0.50	94.76±0.73	95.84±0.79	88.51±0.43
LBS	92.53±0.62	100±0.50	-	96.24±0.82	96.48±0.82	91.73±0.59

Conclusions

1. The most suitable combination for the production of LBS is a mixture of sweet and acid whey (50%: 50%), the amount of culture - 30%, temperature - 29 ± 1 ° C, time 48 ± 2h.

2. LBA can be used in the production of ice cream (0.3-0.4%), as a result the quality of the developed product (sensory parameters and rheological properties) was close to the traditional ice cream produced with a commercial stabilizer.

3. The technology for producing 'Ricotta' cheese was developed using LBS. The production of 'Ricotta' produces a lactose-rich by-product, whey, which retains more than 90% of its original lactose content.

Acknowledgment

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