

Table 1

Comparison of typical parameters from bioreactor cultivations with *Tsukamurella* spec. using sunflower, rapeseed and calendula oil as carbon sources. All parameters were determined at the end of the respective cultivation, except where stated.

Parameter	Sunflower oil	Rapeseed oil	Calendula oil
Cultivation volume [L]	20	20	5
Start concentration of carbon source [g/L]	190	200	120
Cultivation time [h]	140	140	190
Biomass [g/L]	40	39	50
Substrate consumption [g/L]	130	110	100
Volumetric productivity [g/L·h]	0.16	0.09	0.07
$Y_{P/X}$	0.56	0.33	0.28
$Y_{P/S}$	0.17	0.12	0.14
Product concentration [g/L]	22.5	13	14
GL 1 [%] <sup>a</sup>	33	33	15
GL 2 [%]	33	33	24
GL 3 [%]	33	33	61

<sup>a</sup> The exact composition of the longest fatty acid chain at C2 is probably dependent on the oil used.

Table 2

<sup>1</sup>H NMR data of the sugar moieties of glycolipids GL 4 and GL 6 in CD<sub>3</sub>OD/CDCl<sub>3</sub> (30/70), d doublet, t triplet, q quartet, m multiplet, n.d. not determined. Chemical shifts ( $\delta$ ) are given in ppm relative to internal tetramethylsilane and coupling constants are in Hz.

	Proton	GL 4		GL 6	
		$\delta$ [ppm]	J [Hz]	$\delta$ [ppm]	J [Hz]
<b>Sugar A</b>	H-1	5.07	(1-2) 3.6	5.07	(1-2) 3.6
	H-2	3.59 dd	(2-3) 9.8	3.59 dd	(2-3) 9.8
	H-3	3.80 dd	(3-4) 9.0	3.80 dd	(3-4) 9.0
	H-4	4.97 t	(4-5) 9.0	4.97 t	(4-5) 9.0
	H-5	4.31 ddd	(5-6A) 2.8	4.31 ddd	(5-6A) 2.8
	H-6A	4.30 dd	(5-6B) 2.8	4.30 dd	(5-6B) 2.8
	H-6B	4.17 dd	(6A-6B) 12.2	4.17 dd	(6A-6B) 12.2
	<b>Sugar B</b>	H-1	5.15 d	(1-2) 2.9	5.15 d
H-2		3.61 m		3.61 m	
H-3		3.81 m		3.81 m	
H-4		3.35 m		3.35 m	
H-5		4.08 m		4.08 m	
H-6A		4.11 m		4.11 m	
H-6B		3.75 m		3.75 m	
<b>Sugar C</b>		H-1	4.79 d	(1-2) 8.0	4.79 d
	H-2	4.75 dd	(2-3) 9.0	4.75 dd	(2-3) 9.0
	H-3	5.07 t	(3-4) 9.0	5.07 t	(3-4) 9.0
	H-4	3.55 m	(4-5) n.d.	3.55 m	(4-5) n.d.
	H-5	3.38 m	(5-6A) 2.0	3.38 m	(5-6A) 2.0
	H-6A	3.85 dd	(5-6B) n.d.	3.85 dd	(5-6B) n.d.
	H-6B	3.71 m	(6A-6B) 12.0	3.71 m	(6A-6B) 12.0
	<b>Sugar D</b>	H-1	4.32 d	(1-2) 7.6	4.32 d
H-2		3.54 m		3.54 m	
H-3		3.49 m		3.49 m	
H-4		3.86 m		3.86 m	
H-5		3.67 m		3.48 m	
H-6A		4.28 - 4.18 m		3.80 m	
H-6B		4.28 - 4.18 m		3.72 m	

Table 3

<sup>1</sup>H NMR data of the glycolipids GL 4 and GL 6 in CD<sub>3</sub>OD/CDCl<sub>3</sub> (30/70), t triplet, m multiplet. Chemical shifts ( $\delta$ ) are given in ppm relative to internal tetramethylsilane and coupling constants are in Hz.

Glycolipid	Acyl Moiety	Proton	$\delta$ [ppm]	J [Hz]
GL 4 <sup>a</sup>	C18:1	H-2	2.37 m	
		H-3	1.62 m	
		H-18	0.94 t	(17-18) 7.2
		CH <sub>2</sub> CH=	5.39 m	
		CH <sub>2</sub> CH=	2.07 m	
		Rest	1.45-1.27 m	
GL 6	C18:1	H-2	2.37 m	
		H-3	1.62 m	
		H-18	0.94 t	(17-18) 7.2
		CH <sub>2</sub> CH=	5.39 m	
		CH <sub>2</sub> CH=	2.07 m	
		Rest	1.45-1.27 m	

<sup>a</sup> The data for the other C6 and C8 side chains are the same as those reported for GL 3 in [8].

Table 4

Surface activity characteristics of glycolipids from *Tsukamurella* spec. and a derivative, compared to the commercially available biosurfactant *APG 1200 Plantaren*<sup>®</sup>.

<b>Glycolipid</b>	<b>cmc [mg/L]</b>	<b><math>\sigma_{cmc}</math> [mN/m]</b>	<b>Reference</b>
GL 1	10	35	[8]
GL 2	100	23	[8]
GL 3	100	24	[8]
<b>GL 4</b>	200	23	this work
<i>APG 1200 Plantaren</i> <sup>®</sup>	20	27	[8]

Table 5  
 Anti-tumor-promoting activities of oligosaccharide lipids and oligosaccharides: Inhibition of TPA-induced activation of Epstein-Barr virus early antigen (EBV-EA).

Compound	% to control (% viability of Raji-cells) <sup>a</sup>			
	1000	500	100	10
GL 1	9.2 (60)	46.4	74.0	100.0
GL 2	24.1 (80)	62.5	86.3	100.0
GL 3	10.5 (60)	47.0	76.4	100.0
GL 4	11.7 (70)	59.4	80.3	100.0
G 3	2.6 (60)	40.9	69.5	89.5
GG <sup>b</sup>	0.0 (70)	20.7	62.4	82.5

<sup>a</sup> Values are EBV-EA activation (%) in the presence of different concentrations of the test compound (mol ratio/TPA), relative to the control (100%). Activation was attained by treatment with 32 pmol TPA, the tested substances were applied in multiples of this concentration (10-fold to 1000-fold). The numbers in parentheses are the viability rates of the tested Raji-cells. <sup>b</sup> 3-O-D-β-Galactopyranosyl glycerol [28].