



Universidad Nacional del Litoral
Facultad de Bioquímica y Ciencias Biológicas
Laboratorio de Fermentaciones

CURSO INTERNACIONAL DE LA RED RESALVALOR
VALORIZACIÓN DE RESIDUOS, BIOECONOMÍA Y ECONOMÍA CIRCULAR

Valorización biológica del glicerol subproducto de la fabricación de biodiésel

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1

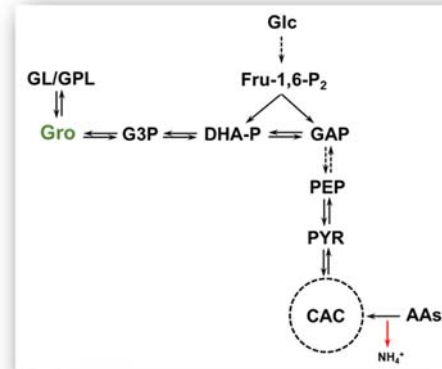
El panorama de la biovalorización del glicerol

Buscador: SCOPUS
Criterio de búsqueda: *glycerol + valorization (+ microbial)*
Fecha de búsqueda: 14/09/2021



2

La factibilidad para la biovalorización del glicerol



Referencias

Glc: glucosa; Fru-1,6-P₂: fructosa-1,6-bisfosfato; DHA-P: dihidroacetona fosfato; G3P: glicerol-3-fosfato; Gro: glicerol; GL/GPL: glicerolipidos / glicerofosfolipidos; GAP: gliceraldehído-3-fosfato; PEP: fosfoenolpiruvato; PYR: piruvato; CAC: ciclo del ácido cítrico; AAs: aminoácidos

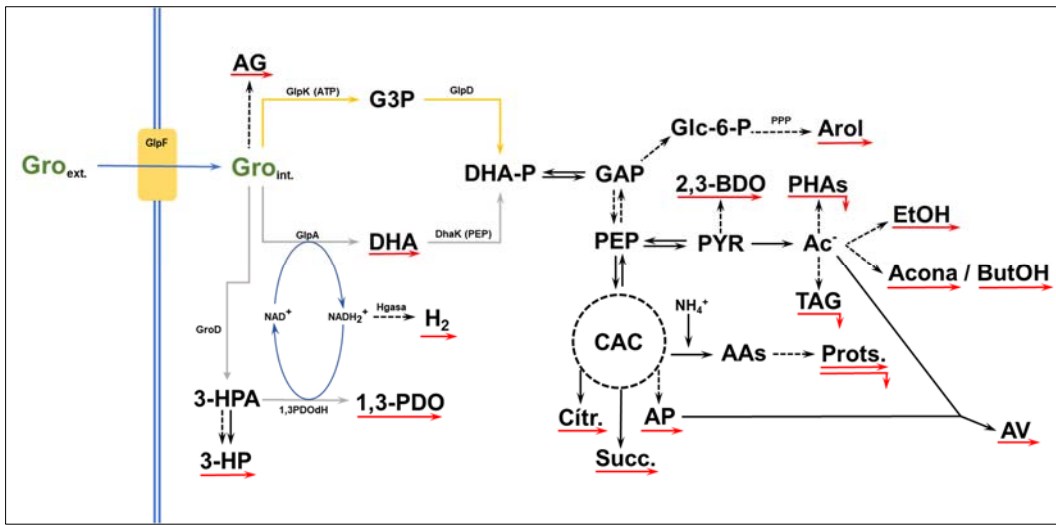
3

Algunos bioproductos microbianos obtenidos desde el glicerol

Bioproducto	Microorganismos	Referencias
Hidrógeno	<i>Clostridium</i> spp. <i>Escherichia coli</i>	Trichounian & Trichounian, 2015 Mangayil et al., 2012
Etanol	<i>Escherichia coli</i> [rec]	Yazdani & Gonzalez, 2008
1-butanol	<i>Clostridium</i> spp.	Jensen et al., 2012
1,3-propanodiol	<i>Klebsiella pneumoniae</i>	Yang et al., 2018
Ácido propiónico	<i>Propionibacterium</i> spp. <i>E. coli</i> [rec] <i>Clostridium</i> spp.	Cavero-Olguin et al. 2021 Gonzalez-Garcia et al. 2020, 2017 Rane et al., 2020
Ácido 3-hidroxipropiónico	Consorcio microbiano	Zhang et al., 2021
Ácido 2,3-Dihidropropanoico (ácido glicérico)	<i>Acetobacter tropicalis</i> <i>Glucobacter</i> sp.	Habe et al., 2021
2,3-butanodiol	<i>Klebsiella</i> spp. <i>Enterobacter</i> spp. <i>Serratia</i> spp. <i>Raoultella</i> spp. <i>Bacillus</i> spp.	Song et al., 2019 Ripoll et al., 2016
Ácido succínico	<i>E. coli</i> <i>Enterobacter</i> sp. <i>Yarrowia lipolytica</i>	Ripoll y Betancor, 2021
Ácido pentanoico (ácido valérico)	Consorcio microbiano	Veras et al., 2020
Ácido cítrico	<i>Yarrowia lipolytica</i>	Börekçi et al., 2021
Acetinas	<i>E. coli</i> [rec]	Zada et al., 2020
1,3-Dihidropropanona (DHA)	<i>Glucobacter</i> spp.	Ripoll & Betancor, 2021
Arabitol	<i>Wickerhamomyces anomalus</i> <i>Candida</i> spp. <i>Hansenula</i> spp.	Amarzetti et al., 2020 Kordowska-Water, 2015
Pocianina	<i>Pseudomonas aeruginosa</i>	Bacame-Valenzuela et al., 2020
Aceite unicelular (SCO)	Hongos Microalgas	Tomás-Peño et al., 2021
PHAs	<i>Cupriavidus necator</i> (<i>Ralstonia eutropha</i>) <i>Bacillus</i> spp. <i>Pseudomonas</i> spp. <i>Halomonas</i> spp. <i>E. coli</i> [rec]	Ganesh Saratale et al., 2021 Koller & Marsalek, 2015 Liu et al., 2015
Proteínas	<i>E. coli</i> [rec] <i>Pichia pastoris</i> [rec]	Palmerin-Carreño et al., 2021 Chiang et al., 2020
Biomasa microbiana	<i>Bradyrhizobium japonicum</i> <i>Azospirillum</i> sp. <i>Pseudomonas</i> spp. <i>Bacillus</i> spp. <i>Penicillium</i> spp.	Vasilev et al., 2017

4

El glicerol como sustrato microbiano

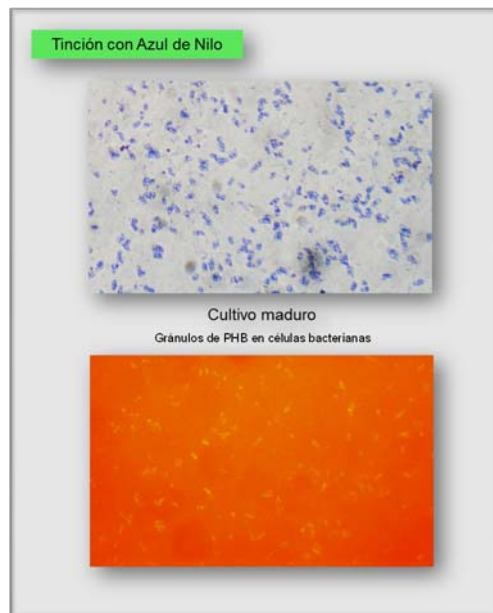
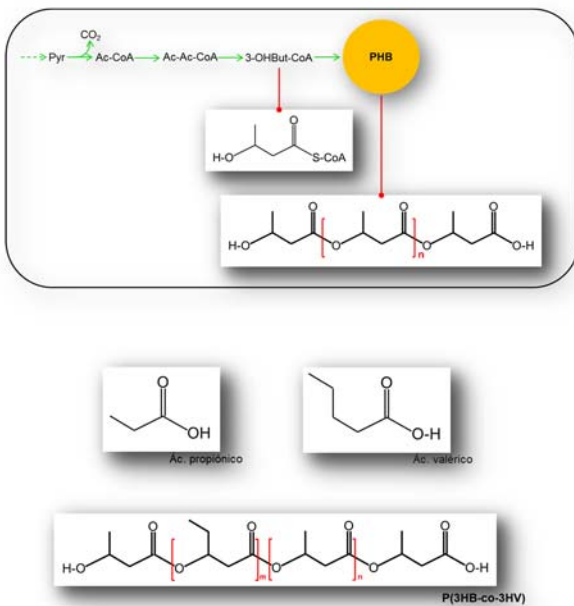


Referencias:

Gro_{ext}: glicerol extracelular; **GlpF:** facilitador del glicerol; **Gro_{intl}:** glicerol intracelular; **GlpK:** glicerol quinasa; **ATP:** trifosfato de adenosina; **G3P:** glicerol-3-fosfato; **GlpD:** G3P deshidrogenasa; **DHA-P:** dihidroxiacetona fosfato; **GlpA:** glicerol deshidrogenasa; **NAD⁺/NADH₂⁺:** dinucleótido de nicotinamida y adenina; **DHA:** dihidroxiacetona; **GA:** ácido glicérico; **DhaK:** dihidroxiacetona quinasa; **PEP:** fosfoenolpiruvato; **GroD:** glicerol deshidratasa; **3HPA:** 3-hidroxi-propionilaldehído; **1,3PDODH:** 1,3-propanodiol deshidrogenasa; **1,3-PDO:** 1,3-propanodiol; **3-HP:** ácido 3-hidroxi-propiónico; **Hgasa:** hidrogenasa; **H₂:** hidrógeno; **Glc-6-P:** glucosa-6-fosfato; **PPP:** ruta de las pentosas fosfato; **AroI:** arabinol; **GAP:** gliceraldehído-3-fosfato; **PEP:** fosfoenolpiruvato; **CAC:** ciclo del ácido cítrico; **Citr.:** ácido cítrico; **Succ.:** ácido succínico; **AP:** ácido propiónico; **NH₄⁺:** amonio; **AAs:** aminoácidos; **Prots.:** proteínas; **PYR:** piruvato; **Ac:** acetato; **PHAs:** polihidroxialcanoatos; **TAGs:** triacilglicerol (SCO); **EtOH:** etanol; **Acon:** acetona; **ButOH:** butanol; **AV:** ácido valérico; — Metabolismo con aceptores finales de e⁻; — Metabolismo fermentativo.

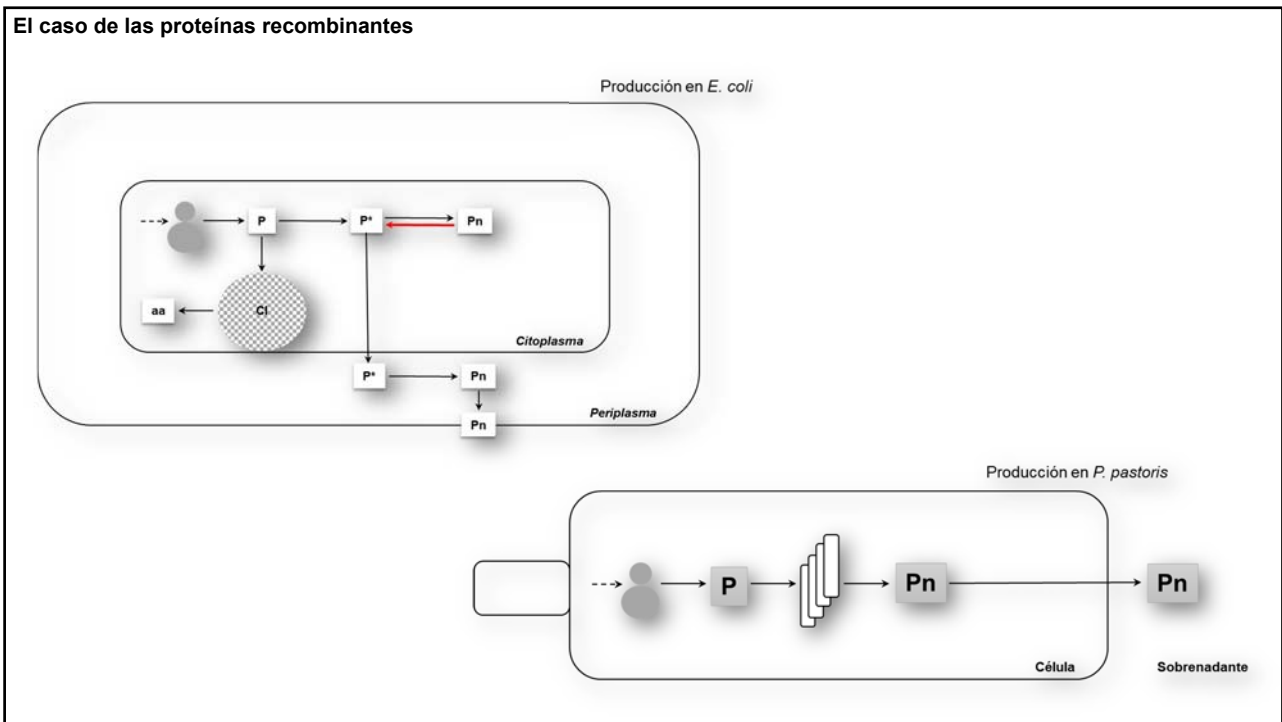
5

El caso del polihidroxialcanoato



6

El caso de las proteínas recombinantes



7

El caso del aceite unicelular (SCO)



Microfotografía de *Halochlorella rubescens*
Gentileza: Laura Modini (FBCB – UNL, Arg.)



Microfotografía de *Nitzschia laevis*
Gentileza: Vanina Márquez (FBCB – UNL, Arg.)

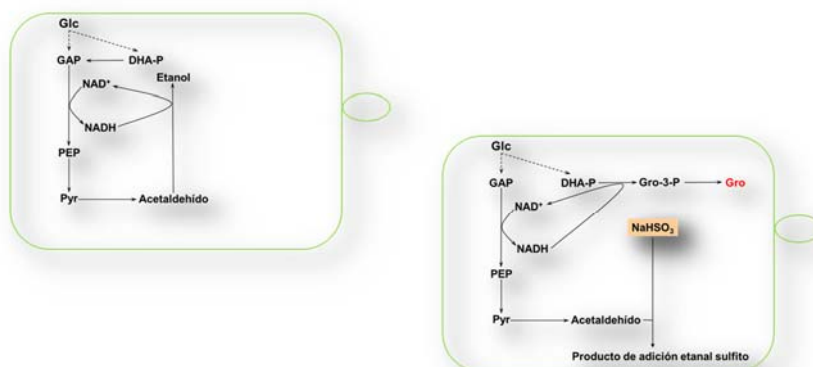


Microfotografía de *Cryptocodinium cohnii*
Gentileza: V. Márquez

8

La incertidumbre del biodiésel. Alternativas biotecnológicas para la producción de glicerol

La fermentación glicérica (en levaduras), o fermentación de Neuberg



9

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10