Nutritional control of metabolite production Fermented products that are used in our daily life are either primary or secondary metabolites produced during the trophophase and idiophase of the microbial growth, respectively.Carbon Source Action Metabolites Producer References Simple carbon Glycerol Interfering Actinomycin D Streptomyces parvullus Foster and Katz, 1981 Erythromycins Saccharopolyspora erythraea Sanchez et al., 2010 Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Non-interfering Simocyclinones Streptomyces antibioticusTu 6040 Theobald et al., 2000 Monosaccharide Glucose Interfering Actinomycin Streptomyces sp. Gallo and Katz, 1972 Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Erythromycins Saccharopolyspora erythraea Sanchez et al., 2010 Penicillin Streptomyces chrysogenum Sanchez and Demain, 2002 Streptomycin Streptomyces griseus Sanchez and Demain, 2002 Non-interfering Bacilysin Bacillus subtilis Ozcengiz et al., 1990 Fructose Interfering Penicillin Penicillium chrysogenum Sanchez and Demain, 2002 Non-interfering Actinomycin Streptomyces antibioticus Rokem et al., 2007 Gentamycin Micromonospora purpurea Sanchez and Demain, 2002 Galactose Interfering Penicillin Penicillium chrysogenum Sanchez and Demain, 2002 Non-interfering Actinomycin Streptomyces antibioticus Rokem et al., 2007 Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Disaccharide Maltose Interfering Bacilysin Bacillus subtilis Ozcengiz et al., 1990 Non-interfering Gentamycin Micromonospora purpurea Sanchez and Demain, 2002 Sucrose Interfering Erythromycins Streptomyces erythreus Rokem et al., 2007 Penicillin Penicillium chrysogenum Sanchez and Demain, 2002 Non-interfering Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Lactose Interfering * Non-interfering Erythromycins Streptomyce serythreus Rokem et al., 2007 Penicillin Penicillium chrysogenum Rokem et al., 2007 Mannose Interfering Erythromycin Streptomyce serythreus Sanchez and Demain, 2002 Streptomycin Streptomyces griseus Sanchez et al., 2010 Non-interfering Kanamycin Streptomyces kanamyceticus Sanchez and Demain, 2002 Complex Starch Interfering * Non-interfering Kanamycin Streptomyces kanamyceticus Rokem et al., 2007 Open in a new tab * Not reported.Rokem et al., 2007; Vastrad and Neelagund, 2011 Non-interfering * Nitrate Interfering Aflatoxin Aspergillus parasiticus Sanchez and Demain, 2002 Non-interfering Rifamycin Amycolatoposis mediterranei Sanchez and Demain, 2002 Organic Urea Interfering Alternariol Alternaria alternata Non-interfering * Amino acids L-alanine Interfering Actinomycin Streptomyces antibioticus Rokem et al., 2007 Bacilysin Bacillus subtilis Ozcengiz et al., 1990 Non-interfering * L-arginine Interfering * Non interfering Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Gramicidin S Bacillus brevis Poirier and Demain, 1981 d,l-Aspartate Interfering Actinomycin D Streptomyces parvullus Foster and Katz, 1981 Non-interfering Streptothricin Streptomyces rochei Sanchez and Demain, 2002 Leucine Interfering Monascus pigment Monascus spp.In order to standardize the production medium, the concept of medium optimization has emerged.Lin and Demain, 1994 Non-interfering Chloramphenicol Streptomyces venezuelae, Rokem et al., 2007 L-isoleucine Interfering Actinomycin D Streptomyces parvullus Foster and Katz, 1981 Non-interfering Spiramycin Streptomyces ambofaciens Lebrihi et al., 1992 DL- phalanine Interfering Actinomycin Streptomyces antibioticus Rokem et al., 2007 Non-interfering Chloramphenicol Streptomyces venezuelae, Rokem et al., 2007 L-proline Interfering Actinomycin D Streptomyces parvullus Foster and Katz, 1981 Non-interfering Streptomycin

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Streptomyces griseus Sanchez and Demain, 2002 Tryptophan Interfering Candicidin Streptomyces griseus Sanchez and Demain, 2002 Non–interfering Actinomycin Streptomyces parvullus Foster and Katz, 1981 Open in a new tab * Not reported.Nitrogen Source Action Metabolites Producer References Inorganic NH+4 Interfering Spiramycin Streptomyces ambofaciens Lebrihi et al., 1992 Cephalosporin Cephalosporium acremonium Sanchez and Demain, 2002 Erythromycin Streptomyces erythreus Rokem et al., 2007 Streptomycin Streptomyces griseus Sanchez and Demain, 2002 Tetracycline Streptomyces spp.The production of specific metabolites in high titer could be possible by maintaining proper control and regulation at different levels via transport and metabolism of extra–cellular nutrients, precursor formation and accumulation of intermediates (Rokem et al., 2007).Fermentation processes, where the precursor(s) of the specific products are not added in the medium, carbon and nitrogen sources present in the medium during their metabolism may initiate the biosynthesis of precursors that regulate the metabolism and influence the end product synthesis (Elibol, 2004).Marwick et al. (1999), while studying antibiotics production from marine bacteria noticed that the gradually assimilating carbon sources, like, galactose generally enhances the production of secondary metabolites (antibiotics).Given this in view, nutrients type and their concentrations in the medium play an important role in commencing the production of primary and secondary metabolites as limited supply of an essential nutrient can restrict the growth of microbial cells or product formation.Singh et al. (2009) during the optimization of actinomycin V production by Streptomyces triostinicus found that biosynthesis of actinomycin V involves tryptophan pathway and addition of amino acid tryptophan to the medium enhances the production.Sanchez and Demain (2002) reported that various secondary metabolites' production such as, actinorhodin, cephalosporin, clavulanic acid, streptomycin, tetracycline, vancomycin etc.Table 1.Table 2.

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