

Brief Insight Halophilic Proteins Adaptation and their Biotechnological Potentials

Hossein Javid Ph.D.,

Microbiologist

Tehran Institute of Reproductive Biomedicine

ACECR, Tehran-Iran

Mohabbat Ahmadi M.Sc.,

Physiologist

Shiraz University

سرشناسه: جاوید، حسین، ۱۳۵۹-

عنوان: Brief Insight Halophilic Proteins Adaptation
and their Biotechnological Potentials

نام پدیدآور: Hossein Javid / Mohabbat Ahmadi

مشخصات نشر: شیراز، شهد سخن، ۱۳۹۵=۲۰۱۷ م.

مشخصات ظاهری: ۶۲ ص.: مصور (بخشی رنگی)، جدول، نمودار

شابک: ۴-۴۲-۶۸۸۴-۶۰۰-۹۷۸ / ۲۰۰۰۰۰ ریال

وضعیت فهرست نویسی: فیا

یادداشت: انگلیسی

یادداشت: کتابنامه

آوانویسی عنوان: بریف انیسایت ...

موضوع: پروتئین

موضوع: Proteins

موضوع: پروتئین های باکتریایی

موضوع: Bacterial Proteins

موضوع: محیط های توانفرسا - میکروب شناسی

موضوع: Extreme Environments-Microbiology

شناسه افزوده: احمدی، محبت، ۱۳۵۹-

شناسه افزودن: Ahmadi, Mohabbat

رده بندی کنگره: ۱۳۶۱ ب ۴ ۵۵۱/۵۵۱ QP

رده بندی دیویی: ۵۷۲/۶

شماره کتابشناسی: ۴۶۰۸۷۸

نوبت چاپ: اول

سال چاپ: ۱۳۹۵

تیراژ: ۱۰۰۰

صفحه آرای: شهد سخن

چاپ و صحافی: ولیعصر

قیمت: ۲۰۰۰۰۰ ریال

حق چاپ برای مؤلفین محفوظ می باشد

انتشارات شهد سخن

شیراز- فلکه هنگ

همراه: ۰۹۱۷۷۰۲۰۵۲۴

Email: javid207m@yahoo.com

Contents

Introduction	5
Life in extreme environments.....	5
Microorganisms and saline habitats.....	5
Different strategies of halophilic adaptation.....	9
Hofmeister series and the effect of salt on protein solubility.....	11
Effect of low-water environments on halophilic proteins.....	13
Insight halophilic protein adaptation.....	16
Common salt-adaptation strategies of halophilic proteins and their amino acid signature.....	16
Specific salt-adaptation of strategies.....	20
Open and closed structure of ligase N from <i>Haloferax volcanii</i>	20
Extra N-terminus domain of 2Fe-2S ferredoxin.....	22
Charged clusters in <i>Haloferax volcanii</i> dihydrofolate reductase.....	23
Large aggregation formation in <i>Halohectothrix ornithi</i> α -Amylase.....	24
Salt-dependent protein secretion system.....	24
Stability of proteins.....	26
Techniques for stabilization of enzyme.....	28
Production of stable enzymes by genetically modified organisms.....	28
Protein engineering and modification of existing mesophilic enzymes.....	28
Chemical modification of enzymes.....	29
Immobilization.....	30
Addition of additives.....	32
Solubility of proteins.....	34
Techniques for increasing solubility of proteins.....	35
Addition of additives.....	35
Fusion of soluble peptide tags.....	35
Genetically modification of surficial residues.....	36
Industrial potentials of halophilic proteins.....	39

Halophilic amylase.....	43
Production of neoagaro-oligosaccharides.....	44
Halophilic β -galactosidase.....	45
Halophilic xylanase.....	46
Halophilic lipase and esterase.....	47
Halophilic proteases.....	48
Bacteriorhodopsins, an optoelectronic protein.....	49
Future perspective.....	50
References.....	52

www.ketab.ir

Introduction

Life in Extreme Environments

Life has been evolving in almost every niche on our planet. Recently some environments that previously were considered to be too violent to support life (e.g., high salinity, extraordinary pH and temperatures) have been discovered to embrace many forms of life. It is natural, however, to consider many of these so called extreme environments as unsuitable habitats for *Homo sapiens*. Microbial survival in these precluding and discordant habitats, however, needs special adaptation strategies. Organisms that thrive and live optimally in these habitats are referred to as extremophiles and polyextremophiles with one or several extreme factors, respectively (Dartnell, 2011). After the discovery of extremophiles and based on the fact that the environments they live in today are closely similar to that of the early shaped planet Earth around four billion years ago and somehow to extraterrestrial worlds (e.g., Mars and Europa); new research model for study of the origin of life and astrobiology developed (Rinaldi, 2007). Classification of extremophiles is based on extreme conditions in which they live. Table 1 includes some types of extremophiles and their habitats. This book reviews and discusses halophilic microorganisms, their habitats and various strategies used by them for adaptation of their proteins and the relevance of amino acid signature in the stability and activity of halophilic proteins in high salt concentrations. Also the effect of low-water environments and organic solvents on halophilic proteins will be considered.

Microorganisms and Saline Habitats

Environments with high salt concentration are among most extreme and strongly discordant habitats to support life. The interests in studying proteins, enzymes and intracellular biochemical processes of halophiles have been raised in many laboratories to understand their enigmatic

strategies, by which they are capable to thrive, tolerate and colonized in such extreme habitats. Isolated enzymes and proteins from extremophiles, due to their extraordinary properties to work in such harsh conditions, are considered as useful catalysts for a variety of applications in biotechnology (Champdore, 2007). Divers types of living organisms in different saline environments can be either halotolerants or true halophiles. Halotolerant organisms are those that thrive in low salt habitats but also are able to tolerate partially high salt concentrations, while the halophilic (salt-loving) organisms have a vital need of salt for their optimal growth. Based on salt requirements, halophiles are classified in different groups. Slight halophiles optimally thrive at low salt concentrations (0.2-0.5 M), moderate halophiles prefer moderate salt concentration (0.5-2 M) and extreme halophiles require more than 3 M salt (Table 2) for optimal growth (Joo, 2005).