DISTRIBUTION OF PESTICIDES, HERBICIDES, SYNTHETIC PYRETHROIDS AND POLYCHLORINATED BIPHENYLS IN SEDIMENTS FROM DRAINS OF DELHI, INDIA

D.Mwo ct[3], U.Mwo ct[3], O.O kuj tc[3], UM.Ukpi j[3], E.U.Uj cto c[3], UF.O cmj klcpk[3], D.Ugpi wr vc[3], M.U.Ucly cp[4] cpf M.Ugpyj krl Mwo ct[4]

[3] P cvkqpcl Tghgtgpeg Vtceg Qti cpke Ncdqtcvqt{, Egpvtcl Rqmwkqp Eqpvtql Dqctf, Ctlwp P ci ct, Fgnj k, 332254
[4] Fgr ctvo gpv qh P cwtcl Uekgpegu cpf O cyj gm cvkeu, Ucxcppcj Uvcvg Wpkxgtuki{, 543; Eqnngi e Uvtggv, Ucxcppcj, IC 53626, WUC

Abstract

Uwthekcn ugf ko gpv htqo P gy Fgnj k ftckpu y gte cpcn{|gf hqt qti cpqej ntkpg r guvkekf gu (QERu), j gtdkekf gu, u{pyj gvke r {tgyj tqkfu (URu) cpf r qn{ej ntkpcvgf dkr jgp{n (REDu). J gtdkekf gu eqpuvkwvg; ;' qh yj g vqvcl qti cpqej ntkpg mqcf. Avtc| lkpg y gte r tgfqo kpcpv eqo r qwpf (9322/362.222 pi li ft) y v am qpi j gtdkekf gu hqmqy gf d{ r gpf ko gyj cnkp (4: 22/43.222), dwucej qt (PF/3422), URu (92/; ; 2), QERu (; 0/362) cpf REDu (20226/2066). Co qpi URu, e{ r gto gyj tkp (92/992) y cu r tgxcngpf hqmqy gf d{ e{fnwyj tkp (PF/432). Co qpi QERu, α/J EJ, r . r ø/FFV, γ/J EJ, q. r ø/FFV y gte r tgfqo kpcvg eqovo kpcpu. Eqpecpvtcvkqpu qh REDu y gte qpg qh yj g my gu gxet tgeqtf gf kp yj g ftckp ugf ko gpv. Kp cff kkkqp vq ngi c
{ qti cpke r qmwcpu, j gtdkekf gu cpf URu ugeo vq dg j ki j n{ wugf kp Kpf kc.

Introduction

Hqt r cuv hgy f gecf gu ugxgtcl qti cpke r qmwcpu kpelwf kpi qti cpqej ntkpg r guvkekf gu (QERu), j gtdkekf gu, r qn{ej ntkpcvgf dkr jgp{n (REDu) cpf u{pyj gvke r {tgyj tqkfu (URu) y gte gzvgpukxgn{ wugf kp kpf wt{ ci tkewnwtg cpf r wdnke j gcnyj ugevqt. Vy qtnf y kf g. Uo g qh yj gug eqo r qwpf u j cxg dggp dcppgf kp f gxgnqr gf cpf f gxgnqr kpi eqwpvtkgu kpelwf kpi Kpf kc. j qy gxet uqo e f gxgnqr kpi eqwpvtkgu ctg uvkm wukpi yj gug eqo r qwpf u dgecwug qh yj gkt mqy equ cpf xgtucvknkv{[1-4]. Vj g Kpf kcp eqpuwo r vkqp qh r guvkekf gu ku cr r tqzko cvgn{ 7.222 o gvtke vqpu, y j gte 92 ' ceeqwpvu hqt FFVu. J EJ u (qti cpqr jqr j qtwu r guvkekf gu (QRRu)[5]. O qu qh yj gug eqo r qwpf u ctg kf gpvhhkgf cu j gro qpg f kutwr vgtu, y j kej ecp ngcfu vq cnvgtcvkqp qh pqto cl hwpevkqpkpi qh gpf qetkpe cpf tgr tqfwevkqp u{uvgo kp j wo cpu cpf y knf nkhg[6]. Tgeqi pkkqp qh yj gug eqpugswgpeg j cu ngf vq yj g kpvgtpcvkqpcl tguvtkevkqp cpf dcp qp 34 r gtukuvgpeg eqo r qwpf u kpelwf kpi REDu cpf ugxetcl QERu.

Ftckpci g u{uvgo o kzgf y kyj o wpkekr cl y cuvg cpf ci tkewnwtcl cevkxkkgu ku xwnpgtcdng vq gpxktqpo gpvcl fco ci e htqo cpyj tqr qi gpke cevkxkkgu. Vj g kpetgcug kp j wo cp ugwgo gpu, y j g ci tkewnwtcl y cuvg, o wpkekr cl ugy ci e f kuej ci e f ktgevn{ vq yj g ftckpu j cxg ngf vq yj g kpetgcugf eqpegpvtcvkqpu qh qti cpke r qmwcpu kp ftckpu uwthkekcl ugf ko gpvu. Fwg vq yj kt r j {ukqej go kcnl r tqr gtvkgu cpf tgecnekvtcpec, o cp{ encuugu qh qti cpke gpxktqpo gpvcl eqovo kpcpu gpf vq ceewo wlcvg kp ugf ko gpvu. Vj g f tgf i gf ugf ko gpvu qh yj g ftckp gjkj et wugf hqt ci tkewnwtcl r wtr qugu qt hqt ncpf-hkmkpi y j kej ngcfu vq f ktgev qt kpf ktgev ko r cev j wo cp j gcnyj cu y gm cu vq y knf nkhg[8]. O wpkekr cl cpf kpf wutkcl ftckpu ctg yj g o clqt tqwugu qh ej go kcnl eqovo kpcvkqpu vq yj g pgctd{ tkxgtu cpf y cvet dqf kgu. Vj gte r tgugpeg kp y cvet o c{ kpetgcug yj ki et ngxgn kp y cvet. ugf ko gpu cpf dkqvc. Kl j cu dggp tgr qtvgf yj cv twp-qhhu htqo eqovo kpcvgf ci tkewnwtcl uqknu cluq j cxe tguwnl j ki j gzvgpl qh eqovo kpcvkqp ctqwpf Fgnjk tkxet cpf ftckpci e u{uvgo[4]. Vj gug r guvkupul r qmwcpu pggf tgi wut o qpkqtkpi kp Kpf kc[7-8]. Kp yj ku uwf{, y e cpcn{|gf QERu, j gtdkekf gu, URu cpf REDu kp uwthkekcl ugf ko gpv htqo ftckpu qh Fgnj k Kpf kc.

Materials and Methods

Vy gpv{ qpg uwthkekcl ugf ko gpv uco r ngu htqo hkxe ugngevgf mqecvkqpu y gte eqmgevgf wukpi uvcknngu uvggl Xcp/ Xggp i tcd uco r ngt. Ko o gfkcvgn{ chvet eqmgevkqp, uco r ngu y gte yj qtqwi j n{ j qo qi gpk| gf cpf cp cnkswqv vtcpuhgttgf kpvq c r tg/enccpgf i ncuu lct. Vj g uco r ngu y gte uvqtgf kp htgg| gt cv /42ºE wpvkl ej go kcnl cpcn{uku. J qo qi gpk| gf y gv uco r ng (5/32 i +) y cu o kzgf y kyj uqfkwo uwlr j cvg cpf Uqzjngv gzvtcevgf hqt 38/j wukpi

f kej nqtqo gyj cpng0'Vj g"gzvtcewu"y gtg"eqpegpvtcvgf "vq"pgct"7"o n'kp"tqvcvcr qwu"*Dwej k"Uy k| gtncpf +0'O qkuwvtg" eqpvgpv'y cu'f gvgto kpgf "vq"tgr qrv'f cvc"qp'f t{"y gki j v'dcuku0'Vj g"Hqtkulkn'eqnwo p"ej tqo cvqi tcr j "y cu"ecrtkdgf "qw" vq "ejgcpwr "yj g"uco r ng0'Vj g"eqpegpvtcvg "uco r ng"y cu"cf f gf "vq"yj g"eqnwo n"cpf "gnwkqp"r tqegfwtg"y cu"f kxkf gf "kp" yj tgg"htcevkqpu"cu"hqnqy u<'H3<'42o N'qh'j gzcpg."H4<'32o N'qh'f kej nqtqo gyj cpg<j gzcpg"*3<5"x lx+'- 32o n'qh' fkej nqtqo gyj cpg<j gzcpg"*3<3"x lx+' "37"o n'qh'fkej nqtqo cpg. cpf "H5<37"o n'q h'Cegvqpkvtkng0'Vj g"htcevkqp"H3" y cu'f kuectf gf "cu'kv'eqpvckpgf "nqp/r qnct"eqo r qwpf "cu'j {ftqectdqpu0'Vj g"htcevkqp"H4"cpf "H5"y gtg"gxcr qtcvgf " ugr ctcvgn "wpfgt"c"i gpvng"uvtgco "qh'r wtkhkgf "pkvtqi gp"i cu"kp"o ktq "eqpegpvtcvqt"*Vwtdqxcr "KK'Ecrkr gt'Nkhg" uekgpeg."WUC+'vq"3"o n'cpf "cpcn| gf "hqt"vcti gv'eqo r qwpfu0'S wcpvkhkecvkqpu'qh'QERu'y gtg"ecttkgf "qw"wukpi "i cu" ej tqo cvqi tcr j "gswkr r gf "y kj "cp'gngevtqp'ecr wtg'f gvgevqt"*GEF +0'C'47"o "x'2042"o o "kf 'Grkxg/3"2055'Üo "qh'7' ' "f kr j gp{rqn{ukqzcpg"cpf "; 7"' "f ko gyj {r qn{ukqzcpg+'eqnwo p"y cu'wugf0'Vj g"eqnwo n"ogo r gtcwwtg'r tqi tco " y cu"cu"hqnqy u<'Vj g"qxgp'ogo r gtcwwtg'y cu'kpkkcl"o ckpvckpgf "cv'392ⁿE"cpf "r tqi tco o gf "vq"kpetgcug"cv'9ⁿE" o kp/³"vq "442ⁿE"cpf "ci ckp'tco r gf "vq"472ⁿE'cv'7ⁿE"o kp/³"cpf "j gnf "hqt"80 8"o kp0'Vj g"kplgevqt"cpf "f gvgevqt" ogo r gtcwwtg'y gtg"o ckpvckpgf "cv'472ⁿE"cpf "572ⁿE'tgur gevkxgn{0'Pktqi gp"i cu'y cu'wugf "cu'ecttkgt'cv'yj g"hqy "tcvg" qh'3022o n'o ko kp/³0"

Table 1.
O gcp"cpf "tcpi g"eqpegpvtcvkqp"*pi lj "f t{'y +'
qh"'cti gv'cpcn{ gu'kp'ugfko gpvu''ntqo "Fgrj k'f tckp0

Eqo r qwpfu	Tcpi g		O gcp
	O kp	O cz	
Pesticides (OCPs)			
/J EJ	PF	86	4:
/J EJ	;0Œ	47	306
/J EJ	PF	34	32
Crftkp	PF	PF	PF
Fkgnftkp	PF	50Œ	50Œ
/gpfquwrhcp	PF	90Œ	90Œ
/gpfquwrhcp	PF	80Œ	60Œ
r.r)FFG	PF	20Œ	20Œ
q.r)FFV	PF	;0Œ	90Œ
r.r)FFV	PF	39	32
Sum OCPs	**9.0**	**140**	**70**
Herbicides			
Crrcejmt	PF	76	76
Dwcejmt	PF	3422	932
Rgpfko gyj crkp	4:22	43.222	36.222
Cvtc| kpg	9322	362.222	82.222
Sum Herbicides	**9900**	**160,000**	**75,000**
Synthetic Pyrethroids (SPs)			
E{hnwjtkp	PF	432	352
Hgprtqrcwjtkp	PF	PF	PF
E{jcnqwjtkp	PF	PF	PF
E{rgtogwjtkp	92	992	472
Fgnco gwjtkp	PF	PF	PF
Hgpxgnetcvg	PF	PF	PF
Sum SPs	**70**	**980**	**380**
PCBs	**0.004**	**0.444**	**0.105**

PF ? "pqv'fgvgevgf

Ugr ctcvkqp"qh'j gtdkekf gu"cpf "URu"y gtg"r gthqto gf "y kj " J RNE"u{uvgo "wukpi "WX'fkqfg"Cttc{"f gvgevqt"*FCF +0' Hqt'j gtdkekf gu"cpf "URu"y cvgngpi yj u'wugf "432"("427'po " tgur gevkxgn{0" O qbkng" r j cug" y cu" Cegvqpkvtkng<y cvgt" *92<52+'hqt'j gtdkekf gu"cpf ": 2<42'hqt"URu'cv'yj g"hqy "tcvg" qh'207"o n'o ko kp/³0"'Gzvtcev'kplgevkqpu"y kj "42"Ùn'uco r ng" nqqr "y gtg"ej tqo cvqi tcr j gf "qp'c'372'x'608'o o "kpvgtpcl" fkco gvgt. E3: "tgxgtugf "r j cug."\ QTDCZ "Gekr ug"ZFD " *Ci kngpv+"' eqnwo p" y kj " 7Œ " Ùo " r ctvkrng0" Vj g" eqpegpvtcvkqpu'qh'cpcn{g'y gtg'f gvgto kpgf "d{'eqo r ctkpi " yj g" r gcm' ctgc" qh" yj g" uco r ngu" cpf " yj g" hkxg" ngxgn" ecrkdtcvkqp" ewtxgu" qh" yj g" uvcpf ctf u0" Vj g" eqttgncvkqp" eqghhkekgpv'qh'ecrkdtcvkqp"ewtxgu'y gtg"cnl'i tgcvgt"yj cp" 20; ; 0'Vj g"r gcm'kf gpvkhkecvkqp"y cu"eqpf wevgf "d{'yj g" ceewtcvg'tgvgpvkqp'ko g"qh'gcej "uvcpf ctf 0'Cnl'uco r ngu" y gtg"cpcn| gf "y kj "s wctkx{ "cuuwtcpeg0'Tgeqxgt{'uwf { " y cu "wpfgtvcmgp 'vq 'f go qpuvtcvg 'yj g 'ghhkekgpe{ "qh"yj g" o gyj qf "d{ "ur kmkpi "yj g"uco r ng"y kj "mpqy p"swcpvkv{"qh" vcti gv'eqo r qwpf"o kzwtg'cpf "tgeqxgt{ "tcpi gf "ntqo ": 2" vq"328" "*Õ7/; ' +0"
""

Results and Discussion

Eqpvco kpcvkqp"r tqhkrgu"qh"QERu. j gtdkekf gu. URu"cpf " vqvcl'REDu'j cxg'dggp'ikuvgf "kp'Vcdng"30Co qpi 'QERu.'α/ J EJ "ku'cdwpfcpv'eqpvco kpcpv'hqnqy gf "d{'r .r ø'FFV."γ/ J EJ." q.r ø'FFV." α/gpfquwrhcp." β/gpfquwrhcp." cpf "' fkgnftkp."β/J EJ "*Hki wtg"3+0'J ki jgt"r tqr qtvkqpu"qh'α/ J EJ "yj cp"kp"yj g"γ/J EJ "kp"ugfko gpvu'uwi i guvkpi 'tgegpv" kpr wv' vq " vgej pkecl' J EJ " o kzwtg" *eqpvckpkpi " 92 " α/." 37 " γ/." 8 " β/." cpf "; ' δ/"J EJ +"kp"Fgrj k'o wpkekr cl" y cuvgy cvgt'f tckpu0" /J EJ "j cu"j ki j "xcr qt"r tguuwtg"cpf " J gpt{ ø'ncy "eqpuvcpv'yj gtghqtg."yj g"y kn'ecukn{'fgi tcf g" kp"uqkn'cpf "ugfko gpv0'Vj g"xcnwg'qh'α/J EJ lδ/J EJ "ku"

608670 "hqt"kpfuxwtkcri'J EJ u'cpf "2"hqt"kpfkcpg."tgurgevkxgn{'0'Kp"vj ku'uvwf{"vj g'tcvkq'qh" /"vq" /"kuqo gtu"* 1 'tcvkq+'
y gtg'40 "*rqqngf "o gcp'xcnwgu+'y cu"y gm'dgmqy """kp"vj g'vgej pkcn'o kzvwtg'*k0g0'6 /9+'cpf "vj gtghqtg"kp'cff kvkqp"vq"
vgej pkcn'J EJ "o kzvwtg."wuci g'qh'kpfcpg'kp"Kpfkc'ecppqv'dg"ki pqtgf0'Vj g'mqy " 1 'tcvkq'kp'vj g'ugfko gpv'uco r ngu"
o ki j v'dg'f wg'vq'uqwtegu'qh'r rtkhhgf 'kpfcpg'kp'vj g'ctgc'eqttgur qpfkpi 'vq'vj g'mqy 'xcnwgu'r tgxkqwun{'tgeqtfgf "kp
Kpfkcp"uwthceg"ugfko gpvu0'Pgzv'vq" /J EJ ."j ki j gt"eqo r qukvkqp"qh'r .r ø'FFV"kp"ugfko gpv'kpfkecvgf "uqy "
f gi tcfcvkqp"qh'FFVu"qt"htguj "kpr wv'qh'vgej pkcn'FFV[10]"kp'Fgnj k'tkxgr"cpf "f ctkpi g'u{uvgo u0'Vj g"vgej pkecn'
o kzvwtg'qh'FFV'j cxkpi "c"@ 2 " qh'r .r ø'FFV'cmqpg"y j cej "o c{"dg'f gi tcfgf "vj tqwi j "o ketqdgu0'Uko knkctn{.'vj g
FFG"o c{"cnuq"i gv'f gi tcfgf "vj tqwi j "dkqmqi kecn'cevkxkvkgu0'Vj g'tcvkq'qh'r ø'FFV'cpf "r ø'FFG'ecp"dg"wugf "vq"
guvko cvg"y j gvj gt'tgegpv'kpr wvu'qh'vgej pkcn'FFV"gzkuv0'I gpgtcm{.'c"tcvkq'qh'2055"qt"nguu"ku"eqpukfgtgf "cu"ci gf "
o kzvwtg. "y j kmg"c"tgncvkxg{'j ki j "r r ø'FFV'r r ø'FFG'tcvkq'ko r nkgu"c"tgegpv'kpr wv0"Kp"qwt"uvwf{"y g'eqwnf "pqv"
f gvgev'r .r ø'FFG'y g"cpvkekr cvg'vj cv'htguj "FFV'
kpr wv'ukmn"c" r qukkdkmkv{ "kp" Fgnj k' tkxgt" cpf "
f ctkpi g" u{uvgo u0' FFV' ku" ukmn" dgkpi " wugf "
y qtnfy kfg'r ctkewnctn{'kp"f gxgnqr kpi "eqwpvtgu"
vq"gtcfkecvg"o cnctkc"cpf "f gpi wg0'Pgctn{": 7" qh"
vj g"FFV'r tqf wegf "kp'Kpfkc"ku"wugf "hqt"o quswkvq"
eqpvtqn"vj gtghqtg"vj g"ngxgnu"qh" FFV'qdugtxgf "
eqwnf " dg" cvtkdwvgf " vq" o wpkekr cn" y cuvg cvgt "
kphmqy "htqo "tgukfgpvkcn'ctgcu'vq "vj g'cf lqkpkpi "
tkxgt" u{uvgo u0' Eqpvco kpcvkqp" qh' α/" cpf " β/
gpfquwhncp"cpf "f kgnftkp"ecppqv'dg"ki pqtgf 0'

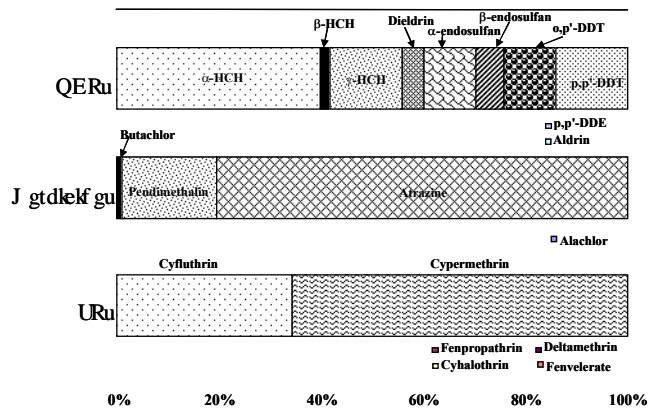Figure 1.'QERu'j gtdkekfgu'cpf "URu'kp'F gnj k'
f tckp"ugfko gpv0'

Table 2. Ecpcfkcp 'Ugfko gpv'S wcnkv{ I wkfgnkpgu'*Htguj "y cvgt+'hqt'vj g'rtqvgevkqp"qh'cs wcvke"nkhg'						
I wkfgnkpgu'*Ûi Ini 'f t{'y v+	FFF"	FFG"	FFV"	Fkgnftkp"	/J EJ "	Vqvcn'REDu"
KUSI "	507"	306"	304"	40" "	206"	56"
RGN"	:07"	80" "	60" "	809"	306"	499"
·KUSI /Kpvgtko "Ugfko gpv'S wcnkv{ I wkfgnkpg=RGN'Rtqdcdng'Ghhgev'Ngxgn0'						"

Eqpegpvtcvkqpu"qh"QERu"qdugtxgf "kp "vj ku"uvwf{ "y gtg "eqo r ctgf " vq "vj qug"qh"Ecpcfkcp"Ugfko gpv'S wcnkv{
I wkfgnkpgu'*KUSI +'cpf "Rtqdcdng'Ghhgev'Ngxgn'*RGN+[11]'*Vcdng'4 +0'FFVu."f kgnftkp"cpf "γ/J EJ "*kpfcpg+'pqvkegf "
kp"vj ku"uvwf{"y gtg'j ki j gt"cp"KUSI 'j qy gxgt."mqy gt"vj cp'RGN0Eqpvkpwgf "qeewttgpeg'qh'FFV."kpfcpg"kp'Kpfkcp"
gpxktqpo gpv'y qwf "ecwug"ugtkqwu'j cmj "vj tgcv'vq "cs wcvke"qti cpkuo u'y j ej "nkxg"kp"vj g'cs wcvke"dqf {'qh'Fgnj k'
f tckpu'tgegkxkpi "y cvgtu0'

Kp" Kpfkc. "cdqwv" 8222" vqpu"qh"j gtdkekfgu"dggp "wugf "hqt"y ggf "eqpvtqn"o ckpn{"kp"kttki cvgf "etqr u"cpf "qp"
r ncpvcvkqpu[12]0'J gtdkekfgu"eqpuvkwg; ; ' "qh'vj g"vqvcn'qti cpqej mqtkpg'nqcf "kp"ugfko gpv'kp'vj ku"uvwf{0'Cvtc| kpg"
cmqpg'eqpvtkdwgf "; 2' "qh'vj g"vqvcn'qti cpqej mqtkpgu'*Vcdng"3 ."Hki wtg"3 +'hqmqy gf "d{"r gpfko gvj cmp"*3; ; +"
dwcej qt'cpf "cncej qt0Cvtc| kpg'*4ej mqtq/6/gvj {nco kpq/8/kuqr tqr {nco kpq/3.5.7/vtkc| kpg+."c"ej mqtkpcvgf "vtkc| kpg
j gtdkekfg"ku"qpg"qh'vj g'o quv'y kfgn{"wugf "r guvkekfgu"kp"etqr u'nkmg"o ck| g."uwi ctecpg."ekvtwu"htwkvu."uqti wo ."
r kpgcr r ng"cpf "j cu"dggp"uqf "wpfgt'f khhgtgpv'eqo o gtekcn'pco g"nkmg'Ccvtgz. "Ccvtcjqn"Dkegr ."cpf "I cucrtko 0Fwg"
vq"ku"gzvgpukxg"wug."r gtukuvgpeg{.j ki j "i gqej go kecn'o qdknkv{'cpf "xctkqwu'vqzke"r tqr gtvkgu."kv'j cu"gpxktqpo gpvcn'
uki pkhkecpeg0'Vj g"o quv'eqo o qp"wug"qh'Cvtc| kpg'j cu"dggp"kp'ej go kecn'htcvo gpv'kpekpgtcvkqp."cf uqtr vkqp."
r j {vqtgo gfkcvkqp"cpf "dkqf gi tcfcvkqp0Vj gug"ctg"cm'vj g'tgcuqpu"y j { "y g"hqwpf "gngxcvgf "cvtc| kpg"kp'ugfko gpv'kp"
vj ku"uvwf{0'Hwtvj gt"uvwf{"tgeqo o gpfgf "qp"vj ku"ej go kecn'hqt"xctkqwu"gpxktqpo gpvcn'cpf "dkqmqi kecn'uco r ngu0'
Cvtc| kpg'cmq"pqvkeg"kp"ctgcu'y kj "ukmpj qrgu."uj cmqy "dgftqem'cswkhgtu. "qt"ci tkewnwtg'f tckpci g"y gmu'y cv'ecp"
r tqxkfg"c"f ktgev'tqwg"hqt"cvtc| kpg'kpvq "vj g"y cvgt cvgt0'Tgegpvn{ "cvtc| kpg"ku"vj g"o quv'y kfgn{ "wugf "cpf "o quv'

gzvgpuksxgn{"uwf kgf "j gtdkekf gu."Kpf kc0'Vqzke"ghhgevu"qh"cvtc| kpg"qp"o ketqdkcn"urgekgu"cpf "co rj kdkcpu"j cxg"cnuq" f go qpuvtcvgf ."cnnj qwi j "vj gkt"o gej cpkuo u"qh"vqzkekv{"kp"uwej "pqpvctigv"urgekgu"tgo ckp"wpengct0'Tguvnuu"qh'vqzkekv{"vguvu"y kyj "cvtc| kpg"kp"bkpct{"eqo bkpcvkqpu"y kyj "qvj gt"qti cpqrj qurj cvgu"kpf kecvgf "o mtg"vj cp"cff kkvg" vqzkekv{"hqt"cnn'eqo rqwpf u"gzegrv"o gvknqrqu0'Rquukdng'j rqyj gugu"ctg"rtgugpvgf "kp"cp"cwgo rv"vq"gzr nc{p"vj g" pqvgf "u{gtgi kunkc'tgncvkqpuj kr "dgv{ ggp"cvtc| kpg"cpf "xctkqwu"qti cpqrj qtqwu"kpugevkekf gu0'Vj g'tguvnuu"uwi i guv' vj cv"vj g"tgur qpug"cff kkqp"o qf gn"f qgu"pqv"cny c{u"ceewtcvgn{ "r tgf kev"o kzvwtg"vqzkekv{ "hqt"ej go kecnu"y kyj " f khhgtkpi "o qf gu"qh"cevkqp[13]0'Rgpf ko gvj cnkp"*Uvqo r "57"GE+"j cxg"cr r nkgf "cv'3222"cpf "4222"ni j g| c"cu"c"r tg/ go gti gpv'j gtdkekf g."gkyj gt"cnqpg"qt"kp"eqo dkpcvkqp"y kyj "qpg'j qgkpi "kp"F gnj k'ctgcu['j cu'uj qy p"ku'ngvgxcvgf "ngxgnu" kp"ecddci g[14]0'Rgpf ko gvj cnkp"ku"ugeqpf "r tgf ko kpcpv'eqpcm kpcpv'hqund "kp"yj ku"uwf {"cnuq"tgr qtvgf "vq"dg"j ki j ki n{ " r gtukuvgpv'kp"uqkn'cpf "ugf ko gpvu[15]0'

P gzv"vq"j gtdkekf gu."URu"uwej "cu"e{r gto gyj tkp"cpf "e{hnwyj tkp"hqwpf "vq"qeewt"i tgcvgt'yj cp"QERu"kp"F gnj k'f tckp" ugf ko gpvu"*Vcdng"3. "Hki wtg"3+"y hkng"hgpr tqr cyj tkp."e{cmqyj tkp."f gnco gyj tkp"cpf "hgpxgngtcv'y cu"pqv'f gvgevgf " kp"cp{"qh'yj g"ugf ko gpv'cpcn{ gf 0'Vj g"r {tgyj tqkf "eruu"qh"kpugevkekf gu."kpenwf kpi "e{r gto gyj tkp. "f gnco gyj tkp"ctg" dgkpi "ugf "cu"uwbuvkwwgu"hqt"qti cpqej mtkpgu"cpf "qti cpqrj qurj cvgu"kp"r guv'eqpvtqn'r tqi tco u "dgecuug"qh"yj gkt" mqy " gpxktqpo gpvcn'r gtukuvgpeg"cpf " vqzkekv{[16]0'E{r gto gyj tkp. "c" r {tgyj tqkf "kpugevkekf g. "ku"c" pgwtqvqzkecpv." chhgevkpi "yj g"egpvtcn'pgtxqwu'u{uvgo[17]. "yj cv"wug f "kp"Kpf kc"vq"eqpvtqn'eqemqcej "cpf "qyj g"kpugev0E{hnwyj tkp"'
]/e{cpq/6/hnwqtq/5/r j gpqz{gbgp{ {n*5+4.4/f kej mtqxkp{|n+4.4/f ko gyj {ne{enqr tqr cpg"ectdqz{ncyg_"r guvkekf g"j cu" dggp"kp"ci tkewnwtcn'uug"kp"yj g"tgegpv{ {gctu"hqt"eqpvtqmkpi "Ngr kf qr vgtcp"r guvu"chhgevkpi "uqnacpcegqwu"crqr u0" E{hnwyj tkp. "ku"c"rgtegpv'kpvtqf wevkqn"vq"yj g"URu"hco kn{. "ku"c"o kzvwtg"qh"hqwt'cevkxg"uvgtgqkuqo gtu"qh"yj g"r ctgpv' eqo r qwpf "e{hnwyj tkp0'Kv'ku"cr r ctgpv'yj cv"wug i g"qh"e{r gto gyj tkp"cpf "e{hnwyj tkp"kp"F gnj k'ctgc"ugg u u"vq"eqo o qp" cpf "yj wu"yj gkt"eqewttgpeg"kp"ugf ko gpv0'

Eqpegpvtcvkqpu"qh"vqvcn'REDu"y gtg"mqy guv"co qpi "cnn'cpcn{gu"*2022C/2066"pi lj ki "ft{"y +"y hkej "eqpvtkdwvg" 202223' "qh'vqvcn'qti cpqej mtkpgu0Eqpcm kpcvkqp'qh'REDu"kp"Kpf kcp"gpxktqpo gpv"ku"tguvtkevgf "vq"tcpuhqto gt'qkn' tcyj gtg "yj cp"ej pkccn'o kzvwtg'yj cv"wugf "hqt'kpf wuutkgu"cpf "gngevtkecn'cr r nkcpegu[7,8]0'

References
3 0'Vcpbcg"U."Mcp/cvkgmcr "U."O cvkctc "U."cpf "Uwdtco cpkcp'CP "Kp<'*Proceedings of the Symposium on West Pacific Scientific Committee of IOC, UNESCO at Okinawa,Japan*'3; ; ; ±'Hgf '4/50'
4 0'Mwo ctk'C."Ukpj c'TM."I qr cn'M0'*Aquatic Ecosystem Health and Manage*'4223±'r6<7270'
5 0'Cy qhqnw'TQ."Hvcfqnk'QU0*Water S A*'4225±'4; <5450'
6 0'Rtcmcuj "Q."Uwct'O ."Tckpc'X."F qi tc'E."Rcn'T."Ncn'T0*Current Sci*'4226±'9; <950'
7 0'Mcw"K'O cyj w'TR."Vcpf qp'UP "Dkmo gf kecn'Ej go "3; ; 8±'3<440'
8 0'J kmo cp'G0*Cancer*'3; ; ; ±53'Lcpwct{."3; /450'
9 0'Ugpyj knl'Mwo ct'M."Mcpcp'M."Uwdtco cpkcp'CP ."Vcpbcg"U0*Environ Sci Pollu Res*'4223±'; <570'
: 0'Ugpyj knl'Mwo ct'M."Mcpcp'M0"Ukpj c'TM."Vcpbcg"U0"I kgu{'LR0*Environ Toxicol Chem*'3; ; ; ±'3<37330'
; 0'I w{| {gmgc'N."Tquckqni'E."Xki kpq'N0"Ucj c'O ."Uctmct'UM0Dj cwtej ct{c'C0*Environ International*'4227±'53<7450'
32 0'Vtcvgtu'VO ."Dgtgwc'O ."Equcu'O E0*Chemosphere*'3; ; ; ±5<36670'
33 0'EEO G0*Canadian Council of Ministers for the Environment*'4228±'Cq/J gcnj "dtcpej ."Quyc c."Ecpcf c0'
34 0'Ucmugpc'U0*Pestic Inf*'4225±'4<80'
35 'Rgr g/Nkpf uvtqo "RC."N{f {'O L0*Environ Toxicol Chem*'3; ; 9±'38<46370'
36 0'Ctqtc'U."I qr cn'O 0*Bull Environ Contam Toxicol*'4226±'95<3280'
37 0'Mwnj tguyj c'I ."Ukpj j "UD."Ncn'UR."[cf wtclw'P V0*Pest Manage Sci*'4222±'78<4240'
38 0'Uc{{gf "K."Rctxg{ "U."Rcpf g{ "U."Dkn/J chgg| "D."J cuwg"T."Tckuwf f kp"U0*Ecotoxicol Environ Safety*'4225±'78<4; 70'
39 0'Ukpj c'U."I qr cn'O 0*Bull Environ Contam Toxicol*'4224±'8: <6220'