

Fluenza (dose UV) necessaria per ottenere l'inattivazione logaritmica incrementale di batteri, protzoi, virus e alghe

Rivisto, aggiornato e ampliato da

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Introduzione

Cronologia delle revisioni

Questo documento rappresenta la seconda revisione di una stesura che risale al 1999. La stesura originale (Wright e Sakamoto 1999) era un documento interno del Trojan Technologies. La prima revisione è stata pubblicata nel 2006 (Chevrefils et al. 2006). I dati delle precedenti revisioni sono stati inclusi qui. Inoltre, sono stati aggiunti i dati degli ultimi 10 anni ed è stata aggiunta una nuova tabella per le alghe. Sono state pubblicate altre due revisioni della sensibilità UV dei microrganismi (Hijnen et al. 2006; Coohill e Sagripanti 2008).

Breve descrizione e criteri di selezione

per il contenuto delle tabelle

Le tabelle 1-5 (solo nella versione scaricabile) presentano un riepilogo dei dati pubblicati sulla curva di risposta alla fluenza ultravioletta (UV) per vari microrganismi che sono patogeni, indicatori o organismi incontrati nell'applicazione, test delle prestazioni e convalida delle tecnologie di disinfezione UV. Le tabelle riflettono lo stato delle conoscenze, ma includono la variazione della tecnica e della risposta biologico-biologica che esiste attualmente in assenza di protocolli standardizzati. Si consiglia agli utenti dei dati per i propri scopi di esercitare un giudizio critico sul modo in cui utilizzano i dati.

Nella maggior parte dei casi, i dati sono generati da sorgenti di lampade monocromatiche ad arco di mercurio a bassa pressione (LP) per le quali la flusso della lampada (irraggiamento) può essere misurato empiricamente e moltiplicato per il tempo di esposizione (in secondi) per ottenere un fluenza incidente sul campione da irradiare; tuttavia, i dati precedenti non sempre contengono i fattori di correzione che sono ora considerati prassi

standard (Bolton e Linden 2003; Bolton et al. 2015a) al fine di determinare la fluenza media erogato ai microrganismi all'interno del campione irradiato. Tali dati non corretti sono contrassegnati e devono essere considerati come limiti superiori, poiché non sono state effettuate le necessarie correzioni. Alcuni dati provengono da lampade ad arco di mercurio a media pressione policromatiche (MP), e in alcuni casi vengono utilizzati entrambi i tipi di lampade. In alcuni casi, la luce UV policromatica filtrata viene utilizzata per ottenere una banda di irradiazione stretta intorno ai 254 nm. Questi studi sono anche designati come LP.

Nessuno dei dati incorpora alcun impatto dei processi di foto-riattivazione. Solo la risposta di inattivazione alla fluenza è documentata. I riferimenti da cui vengono estratti i dati devono essere letti attentamente per capire come vengono calcolate le fluenze riportate e quali sono i presupposti e le procedure nei calcoli.

È intenzione degli autori e degli sponsor mantenere questa tabella dinamica, con aggiornamenti periodici. Le raccomandazioni per l'inserimento nelle tabelle, insieme alla fonte di riferimento, devono essere inviate a:

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I criteri di selezione per l'inclusione sono indicati di seguito:

- 1.I dati devono essere già pubblicati su una rivista peer-reviewed o su altri mezzi di pubblicazione peer-reviewed; alcune eccezioni sono state ammesse quando i dati sono disponibili solo in giornali non peer-reviewed;
- 2.Per le pubblicazioni in cui è stata utilizzata una lampada UV LP o MP come sorgente UV, il flusso calcolato dovrebbe essere determinato utilizzando un apparecchio a fascio collimato; tuttavia, per le altre sorgenti UV, questo criterio non è stato seguito rigorosamente e tali casi vengono annotati;
- 3.Idealmente, il flusso (irraggiamento) dovrebbe essere misurato con un radiometro recentemente calibrato, e quando questo non è stato fatto, un'organismo ben definito dovrebbe essere eseguito come riferimento per fornire un confronto con i valori della letteratura per comprovare che il radiometro è all'interno della calibrazione;
- 4.La pubblicazione da cui vengono estratti i dati deve descrivere le procedure sperimentali, comprese le procedure di collimazione del fascio, le procedure di calcolo della fluenza e le eventuali ipotesi fatte, le procedure di coltura dell'organismo, l'enumerazione e la preparazione per gli esperimenti;
- 5.Idealmente, come già detto, si dovrebbe seguire il protocollo pubblicato da Bolton e Linden (2003) o il Protocollo IUVA recentemente pubblicato (Bolton et al. 2015a). Nei casi in cui questo protocollo non è stato seguito, sono state fornite note in tal senso. Tali dati devono essere considerati come un limite superiore per la fluenza, poiché non sono stati applicati i normali fattori di correzione. In alcuni casi è stato applicato solo il fattore acqua; si ritiene che questi abbiano soddisfatto il criterio del protocollo, poiché il fattore acqua è la correzione più importante.
- 6.I valori dovrebbero essere determinati su un intervallo di fluenze; cioè, una curva di valori di risposta alla fluenza è preferibile ad una singola misura di valore di risposta alla fluenza.

Questi criteri saranno applicati rigorosamente per le future edizioni di queste tabelle.

Per gli utenti di queste tabelle, i seguenti punti possono essere utili per comprendere le informazioni fornite:

- In alcuni articoli, gli autori hanno utilizzato diversi metodi per l'enumerazione del loro microrganismo selezionato e, sulla base di questo, hanno riportato nel loro lavoro diversi valori di risposta alla fluenza rispetto al lavoro di altri. In caso contrario per uno specifico lavoro, una breve descrizione del metodo implementato viene fornita all'interno della scatola contenente il nome del microrganismo testato.
- Per gli studi con sorgenti UV diverse da una lampada LP (ad esempio, lampade MP filtrate, LED UV, lampade ad eccimeri, ecc.) l'intera larghezza alla metà del massimo (FWHM) della banda della

lunghezza d'onda intorno alla lunghezza d'onda di picco è di solito di circa 10-12 nm, ad eccezione del laser accordabile dove la larghezza di banda è < 1 nm.

- Laddove gli autori hanno riportato modelli cinetici basati sui loro dati sperimentali, sono stati utilizzati questi modelli nei calcoli di flusso per queste tabelle. Nei casi in cui non sono stati forniti modelli di adattamento, la fluenza riportata per ogni specifico numero di riduzione del logaritmo è stata estratta mediante linearizzazione grafica (Web Plot Digitizer) tra due punti di dati sperimentali adiacenti nell'intervallo di flusso.
- In alcuni casi, le curve di risposta alla fluenza sono state determinate a diverse lunghezze d'onda, in modo da poter determinare uno spettro d'azione. Questi casi sono indicati come "spettro d'azione"; tuttavia, nelle tabelle sono inclusi solo i dati per lunghezze d'onda vicine a 254 nm. I dati per le altre lunghezze d'onda possono essere ottenuti dal riferimento citato.
- Il lettore deve essere consapevole del fatto che per un determinato microrganismo esiste una diffusione di dati anche dopo l'applicazione dei criteri di selezione. Alcuni studi hanno applicato un'analisi statistica Bayesiana (ad esempio, vedi Qian et al. 2004, 2005) per ottenere una curva media di risposta alla fluenza e limiti del 95° percentile. Alcuni dei fattori che potrebbero influenzare i dati riportati sono: il mezzo (ad esempio, acqua potabile o acque reflue), le differenze nello stato nutrizionale delle cellule da saggiare, la presenza di particelle a causa della mancata dispersione completa delle cellule a seguito di una pre-concentrazione per il saggio del fascio collimato, ecc.
- Per un dato microrganismo, la curva di risposta alla fluenza può dipendere notevolmente dal ceppo esaminato. Questo è il motivo per cui gli studi di un dato ceppo sono stati raggruppati insieme.
- Si noti che i dati riportati nelle tabelle sottostanti provengono da protocolli altamente controllati, di solito utilizzando metodi di coltura e media definiti, metodi di irradiazione, ecc. Questi dati sono utili per la validazione delle tecnologie UV e per l'elaborazione delle normative; tuttavia, poiché la qualità dell'acqua, lo stato nutrizionale, il contenuto di particelle e una serie di altri fattori possono avere un impatto sulle risposte microbiche alla disinfezione in campioni ambientali reali o nell'acqua trattata, tali acque reali dovrebbero essere utilizzate per le valutazioni degli UV in siti specifici e le specifiche di progetto dovrebbero beneficiare dei risultati dei saggi che utilizzano queste acque specifiche del sito.
- In alcuni casi, la qualità dei dati era discutibile e non soddisfaceva alcuni dei criteri di selezione sopra elencati. In questi casi, le voci dei dati sono in corsivo.

Queste tabelle possono essere utilizzate come un utile documento per comprendere la risposte alla fluenza per diversi organismi a diverse lunghezze d'onda, con diverse sorgenti UV; tuttavia, se maggiori dettagli sono importanti per gli utenti di questi dati, devono leggere il riferimento fornito per ogni studio.

Unità di misura e nomenclatura

Nel corso di questa revisione, il fattore di fluenza e l'irraggiamento (unità mW/cm²) sono utilizzati in modo intercambiabile, poiché sono virtualmente identici in un apparecchio a fascio collimato. Si usa il termine fluenza (unità mJ/cm²), che è il termine corretto [vedi Bolton et al. (2015b) per una serie di termini e definizioni raccomandate] piuttosto che dose UV, che è stato usato nelle precedenti revisioni di questo documento; tuttavia, va notato che il termine dose UV è ancora ampiamente usato. Infine, si osserva che in Europa e in altre parti del mondo, le unità W/m² per irraggiamento o tasso di fluenza e J/m² per fluenza (dose UV) sono più comunemente usate. Un mW/cm² = 10 W/m² e 1 mJ/cm² = 10 J/m².

Le tavelle

Sono state preparate cinque tavelle che coprono spore, batteri, virus, alghe e altri microrganismi. Queste tavelle - così come una lista di riferimento - sono troppo grandi per essere stampate, ma la revisione completa può essere scaricata dalla Member Zone sul sito web IUVA all'indirizzo www.iuva.org.



Tabella 1. Fluenza per la riduzione logaritmica multipla per vari tipi di spore

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione							
Spore	Lamp Type	1	2	3	4	5	Protocol?	Notes	Reference
<i>Aspergillus brasiliensis</i> (previously known as <i>Aspergillus niger</i>) ATCC 16404 (dark culture)	LP	122	226	293			yes		Taylor-Edmonds et al. 2015
<i>Aspergillus niger</i>									
ATCC 32625	LP	116	245	370	560		yes		Clauß 2006
ATCC 32625	Excimer 222 nm	90	220	325	430		yes		Clauß 2006
<i>Bacillus anthracis</i>									
Sterne	LP	28	37	52			yes		Nicholson & Galeano 2003
Sterne	LP	23	30				yes		Blatchley III et al. 2005
Ames	LP	25	~40	>120 with tailing		yes			Rose & O'Connell 2009
34F2 (Sterne) method: soil extract-peptone-beef extract agar	LP	23	~40	>120 with tailing		yes			Rose & O'Connell 2009
34F2 (Sterne) method: Schaeffer's sporulation medium	LP	23	36	80			yes		Rose & O'Connell 2009
<i>Bacillus atrophaeus</i>									
ATCC 9372	LP	22	38	55	71		yes		Zhang et al. 2014
	LP	10	16	26	39		yes		Sholtes et al. 2016
	UV-LED 260 nm	6	10	14	19	31	yes		Sholtes et al. 2016
<i>Bacillus cereus</i>									
ATCC 11778	Excimer 222 nm	25	43	69			yes		Clauß 2006
ATCC 11778	LP	52	93	140			yes		Clauß 2006
T	LP	23	30	35	40		yes		Blatchley III et al. 2005
<i>Bacillus megaterium</i> (spores) QMB 1551	265 nm	28	42	55			no		Donnellan & Stafford 1968
<i>Bacillus pumilus</i>									
ASFUVRC	Filtered MP 258 nm	87	130	184			yes		Beck et al. 2015
ASFUVRC	LP	173	348				yes		Boczek et al. 2016
ATCC 27142	LP	68	138	204	272		yes		Boczek et al. 2016
<i>Bacillus subtilis</i>									
ATCC 6633	LP	12	18	24	30	36	yes		Quails & Johnson 1983
ATCC 6633	LP	36	48	59	77		yes		Chang et al. 1985
ATCC 6633	LP	28	40	50			yes		Sommer et al. 1998
ATCC 6633	LP	19	40	60	81		yes		Sommer et al. 1999

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione							
Spore	Lamp Type	1	2	3	4	5	Proto-col?	Notes	Reference
<i>Bacillus subtilis</i> (cont.)									
ATCC 6633	LP	31	47	64	80		yes	Action spectrum	Cabaj et al. 2002
ATCC 6633	LP	25	39	50	60		yes		Nicholson & Galeano 2003
ATCC 6633	LP	24	35	47	79		yes		Mamane-Gravetz & Linden 2004
ATCC 6633 (surface cultured)	LP	11	18	24	31		yes	Action spectrum	Mamane-Gravetz et al. 2005
ATCC 6633 (liquid cultured)	LP	13	23	33			yes		Bohrerova et al. 2006
ATCC 6633 (surface cultured)	LP	9	15				yes		Bohrerova et al. 2006
ATCC 6633 (surface cultured)	Excimer 222 nm	7	12	18	23		yes		Pennell et al. 2008
ATCC 6633 (surface cultured)	LP	19	24	30	35		yes		Pennell et al. 2008
ATCC 6633 (surface cultured)	282 nm	19	29	39	49		yes		Pennell et al. 2008
ATCC 6633	LP	9	17	26	34		yes		Bichae et al. 2009
ATCC 6633	LP	21	32	43	55		yes	Action spectrum	Chen et al. 2009
ATCC 6633 (surface cultured)	LP	18	39	61	82		yes		Sun & Liu 2009
ATCC 6633	LP	24	37	51	80 + tailing		yes		Mamane et al. 2009
ATCC 6633	LP	26	40	55	69		yes		Wang et al. 2010
ATCC 6633	Excimer 222 nm	13	21	30	38		yes		Wang et al. 2010
ATCC 6633	Excimer 172 nm	435	869				yes		Wang et al. 2010
ATCC 6633	UV-LED 269 nm	2	10	17	25		yes		Würtele et al. 2010
ATCC 6633	UV-LED 282 nm	3	11	18	26		yes		Würtele et al. 2010
ATCC 6051	LP	8	13	17	20 + tailing		yes		Jin et al. 2006
TKJ 6312	LP	0.7	1.5	2.3	3.7		yes		Sommer et al. 1999
WN624	LP	25	36	49	60		yes		Nicholson & Galeano 2003
<i>Cylindrospermum</i> spores	LP	14	26	43			no		Singh 1975
<i>Clostridium pasteurianum</i>									
ATCC 6013	LP	3.4	5.3	6.7	8.4		yes		Clauß 2006
ATCC 6013	Excimer 222 nm	4.3	6.1	7.9	9.6		yes		Clauß 2006
<i>Encephalitozoon intestinalis</i>									
(microsporidia)	LP & MP	<3	3	<6			yes		Huffman et al. 2002

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione							
Spore	Lamp Type	1	2	3	4	5	Proto-col?	Notes	Reference
<i>Fischeralla muscicola</i> spores	LP	189					no		Singh 1975
<i>Penicillium expansum</i>									
ATCC 36200	LP	11	38	49	65		yes		Clauß 2006
ATCC 36200	Excimer 222 nm	22	33	42			yes		Clauß 2006
<i>Streptomyces griseus</i>									
ATCC 10137	LP	8.5	13	15	18		yes		Clauß 2006
ATCC 10137	Excimer 222 nm	13	17	20	26		yes		Clauß 2006
<i>Thermoactinomyces vulgaris</i>									
ATCC 43649	LP	55	90	115	140		yes		Clauß 2006
ATCC 43649	Excimer 222 nm	25	38	46	55		yes		Clauß 2006

Tabella 2. Fluenza per la riduzione logaritmica multipla per vari tipi di virus e batteri

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference
<i>Aeromonas hydrophila</i> ATCC7966	LP	1.1	2.5	4.0	5.5	6.9	8.4	yes		Wilson et al. 1992
<i>Aeromonas salmonicida</i> AL 2017	LP	1.5	2.7	3.1	5.9			yes		Liltved & Landfald 1996
<i>Arthrobacter nicotinovorans</i>										
ATCC 49919	LP	8	10	12	14			yes		Clauß 2006
	Excimer 222 nm	10	15	18	20			yes		Clauß 2006
<i>Bacillus cereus</i> (veg. bacteria)										
ATCC 11778	LP	6	7	9	12			yes		Clauß 2006
ATCC 11778	Excimer 222 nm	9	11	14	18			yes		Clauß 2006
<i>Bacillus megaterium</i> (veg. cells) QMB 1551	265 nm	4.6						no		Donnellan & Stafford 1968
<i>Burkholderia mallei</i>										
M9	LP	1.0	2.4	3.8	5.2			yes		Rose & O'Connell 2009
M13	LP	1.2	2.7	4.1	5.5			yes		Rose & O'Connell 2009
<i>Brucella melitensis</i>										
ATCC 23456	LP	2.8	5.3	7.8	10.3			yes		Rose & O'Connell 2009
IL195	LP	3.7	5.8	7.8	9.9			yes		Rose & O'Connell 2009
<i>Burkholderia pseudomallei</i>										
ATCC 11688	LP	1.7	3.5	5.5	7.4			yes		Rose & O'Connell 2009
CA650	LP	1.4	2.8	4.3	5.7			yes		Rose & O'Connell 2009
<i>Brucella suis</i>										
KS528	LP	2.7	5.3	7.9	10.5			yes		Rose & O'Connell 2009
MO 562	LP	1.7	3.6	5.6	7.5			yes		Rose & O'Connell 2009
<i>Campylobacter jejuni</i>										
ATCC 43429	LP	1.0	2.1	3.4	4.6	5.8		yes		Wilson et al. 1992
biotype 1 strain 709/84	LP	0.8	1.3	1.7	2.1			yes		Butler et al. 1987
<i>Citrobacter diversus</i>	LP	5	7	9	11.5	13		yes		Giese & Darby 2000
<i>Citrobacter freundii</i>	LP	5	9	13				yes		Giese & Darby 2000
<i>Corynebacterium diphtheriae</i>	LP	3.4						no		Sharp 1939
<i>Deinococcus radiodurans</i>										
ATCC 13939	LP	113	142	170	205			yes		Clauß 2006
ATCC 13939	Excimer 222 nm	44	57	91				yes		Clauß 2006
<i>Eberthella typhosa</i>	LP	2.1						no		Sharp 1939
<i>Enterococcus faecium</i> Vancomycin-resistant	LP	7	9	11	13	15		yes		McKinney & Pruden 2012

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione									
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference	
<i>Enterococcus faecalis</i>											
ATCC27285	LP	3.7	8.0	14 + tailing				yes		Moreno-Andrés et al. 2016	
DSM 20478	LP	7.1	8.7	13 + tailing				yes		Chen et al. 2015	
DSM 20478	MP	5.5	7.6	12 + tailing				yes		Chen et al. 2015	
<i>Escherichia coli</i>											
ATCC 11229	LP	3.0	4.8	6.7	8.4	10. 5		yes		Chang et al. 1985	
ATCC 11229	LP	2.5	3.0	3.5	5	10	15	yes		Harris et al. 1987	
ATCC 11229	LP	7	8	9	11	12		no		Hoyer 1998	
ATCC 11229	LP	3.4	5.0	6.7	8.3	10		yes		Sommer et al. 1998	
ATCC 11229	LP	3.5	4.7	5.5	6.5	7.5	9.6	yes		Sommer et al. 2000	
ATCC 11229	LP	2.5	3.0	3.5	4.5	5.0	6.0	yes		Sommer et al. 2001	
ATCC 11229	LP	3.9	5.4	6.8	8.2	9.7		yes		Zimmer & Slawson 2002	
ATCC 11229	LP	3.3	4.9	5.7	6.6			yes		Clauß et al. 2005	
ATCC 11229	Excimer 222 nm	4.9	7.7	9.1	10.3			yes		Clauß et al. 2005	
ATCC 11229	LP or MP	1.6	3.0	5.0	6.5			yes		Bohrerova et al. 2008	
ATCC 11229	LP	4.7	6.2	7.2	8.3	9.3		yes		Quek & Hu 2008	
ATCC 11229	MP	2.5	4.0	4.7	5.3	6.0	7.3	yes		Quek & Hu 2008	
ATCC 11229	LP	4.1	5.1	6.2				yes		Bowker et al. 2011	
ATCC 11229	UV-LED 255 nm	5.9	7.9					yes		Bowker et al. 2011	
ATCC 11229	UV-LED 275 nm	4.3	6.2	7.7				yes		Bowker et al. 2011	
ATCC 11303	LP	4	6	9	10	13	15	yes		Wu et al. 2005	
ATCC 11775	LP	1.1	2.0	3.0	3.4	4.0		yes		Quek & Hu 2008	
ATCC 11775	MP	0.9	1.6	2.4	3.0	3.4		yes		Quek & Hu 2008	
ATCC 15597	LP	6.4	8.9	11	12	13		yes		Quek & Hu 2008	
ATCC 15597	MP	5.0	6.8	8.3	9.4	11	12	yes		Quek & Hu 2008	
ATCC 25922	LP	6.0	6.5	7.0	8.0	9	10	yes		Sommer et al. 1998	
ATCC 29425	LP	5.4	8.5	20				yes		Chatterley & Linden 2010	
ATCC 29425	UV-LED 265 nm	3.6	5.9	17	20			yes		Chatterley & Linden 2010	
ATCC 700891	LP	7.3	10	12	13	15		yes		Quek & Hu 2008	
ATCC 700891	MP	4.8	6.8	8.2	9.0	9.8		yes		Quek & Hu 2008	
B	LP	1.0	2.4	4.4	6			yes		Shin et al. 2008	
B	MP	0.9	2.1	4.2	6			yes		Shin et al. 2008	
B ATCC 13033	LP	1.2	3.0	4.7	6.5	8.2	10	yes		Sholtes et al. 2016	
B ATCC 13033	UV-LED 260 nm	1.2	3.0	4.7	6.5	8.2	10	yes		Sholtes et al. 2016	
C	LP	2	3	4	5.6	6.5	8	yes		Otaki et al. 2003	

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Bacterium	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
<i>Escherichia coli</i> (cont.)										
C3000	LP or MP	3.0	4.3	5.5	7.0			yes		Eischeid & Linden 2007
CGMCC 1.3373	LP	3.1	5.9	8.0	13			yes		Guo et al. 2009
CGMCC 1.3373	MP	3.1	5.9	9.6	13			yes		Guo et al. 2009
CN13	XeBr Excilamp 282 nm	5.5	7.5	9.6	12					Matafonova et al. 2012
K12	LP	1.1	1.9	2.6	3.4			no		Qiu et al. 2004
K12 IFO 3301	LP & MP	2	4	6	7	9		yes		Oguma et al. 2002
K12 IFO 3301	LP	1.5	2.0	3.5	4.2	5.5	6.2	yes		Otaki et al. 2003
K12 IFO 3301	LP & MP	2.2	4.4	6.7	8.9	11		yes		Oguma et al. 2004
K12 IFO 3301	UV-LED 265 nm	2.6	4.7	6.6	9.0	12		yes		Oguma et al. 2013
K12 IFO 3301	UV-LED 280nm	3.4	6.9	10	14			yes		Oguma et al. 2013
K12 IFO 3301	LP	1.9	4	6	8			yes		Rattanakul et al. 2014
K12 IFO 3301	UV-LED 285 nm	7.8	13	16	23	34		yes		Oguma et al. 2015
K12 IFO 3301	LP	2	4	6				yes		Oguma et al. 2001
NBIMB 9481	LP	5.9	8.0	9.3	10.5	12		yes		Quek & Hu 2008
NBIMB 9481	MP	4.3	6.2	7.3	8.6			yes		Quek & Hu 2008
NBIMB 10083	LP	2.8	4.4	5.6	6.6	7.6		yes		Quek & Hu 2008
NBIMB 10083	MP	2.5	4.3	5.1	6.0	6.8	7.6	yes		Quek & Hu 2008
OP50	LP	2.0	4.4	6.7	9.1			yes		Bichai et al. 2009
O157: H7	LP	1.5	3.0	4.5	6.0			no		Tosa & Hirata 1999
O157: H7	LP	<2	<2	2.5	4	8	17	??		Yaun et al. 2003
O157: H7 ATCC 43894	LP	1.4	2.8	4.2	5.5	6.9		yes		Wilson et al. 1992
O157: H7 CCUG 29193	LP	3.5	4.7	5.5	7			yes		Sommer et al. 2000
O157: H7 CCUG 29197	LP	2.5	3.0	4.6	5.0	5.5		yes		Sommer et al. 2000
O157: H7 CCUG 29199	LP	0.4	0.7	1.0	1.1	1.3	1.4	yes		Sommer et al. 2000
O25: K98: NM	LP	5.0	7.5	9	10	12		yes		Sommer et al. 2000
O26	LP	5.4	8.0	10.5	12.8			no		Tosa & Hirata 1999
O50: H7	LP	2.5	3.0	3.5	4.5	5	6	yes		Sommer et al. 2000
O78: H11	LP	4	5	5.5	6	7		yes		Sommer et al. 2000
145 Ampicillin resistant	LP	0.8	1.9	3.0	4.7			yes		Templeton et al. 2009
018 Trimethoprim resistant	LP	1.5	3.0	4.0	4.9			yes		Templeton et al. 2009
SMS-3-5	LP	3	5.1	6.5	7.6			yes		McKinney & Pruden 2012
wild type	LP	2.7	4.0	5.3	6.6			yes		Butler et al. 1987
wild type	LP	4.4	6.2	7.3	8.1	9.2		yes		Sommer et al. 2000
	LP	2.0	3.6	5.2	6.8			yes		Hu et al. 2012

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione										
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference		
<i>Faecal coliforms</i>	LP	6	9	13	22			yes		Maya et al. 2003		
<i>Francisella tularensis</i>												
LVS	LP	1.3	3.1	4.8	6.6			yes		Rose & O'Connell 2009		
NY98	LP	1.4	3.8	6.3	8.7			yes		Rose & O'Connell 2009		
<i>Faecal streptococci</i>	LP	9	14	22	30			yes		Maya et al. 2003		
<i>Halobacterium elongata</i> ATCC 33173	LP	0.4	0.7	1.0				no		Martin et al. 2000		
<i>Halobacterium salinarum</i> ATCC 43214	LP	12	15	18	20			no		Martin et al. 2000		
<i>Helicobacter pylori</i>												
Texas isolate	LP	2.2	3.0	3.8	4.6	5.7	6.6	yes		Hayes et al. 2006		
ATCC 43504	LP	4.5	5.7	6.7	7.5	8.0		yes		Hayes et al. 2006		
ATCC 49503	LP	1.7	3.1	4.0	5.3	7		yes		Hayes et al. 2006		
<i>Klebsiella pneumoniae</i>	LP	5	7	10	12			yes		Giese & Darby 2000		
<i>Klebsiella terrigena</i> ATCC 33257	LP	3.6	6.4	9.3	12	15		yes		Wilson et al. 1992		
<i>Legionella longbeachae</i> ATCC 33462	LP	1.4	3.0	4.7	6.3			yes		Cervero-Arago et al. 2014		
<i>Legionella pneumophila</i>												
Philadelphia 2	LP	0.9	1.8	2.8	3.7			no		Antopol & Ellner 1979		
ATCC 33152	LP	1.6	3.2	4.8	6.4	8.0		yes		Oguma et al. 2004		
ATCC 33152	MP	1.9	3.8	5.8	7.7	9.6		yes		Oguma et al. 2004		
ATCC 33152	LP	1.7	3.0	4.3	5.7			yes		Cervero-Arago et al. 2014		
ATCC 33823	LP	1.7	3.1	4.5	5.8			yes		Cervero-Aragó et al. 2014		
ATCC 43660	LP	3.0	5.0	7.2	9.3			yes		Wilson et al. 1992		
Sero group 1	LP	1.7	2.9	4.2	5.4			yes		Cervero-Aragó et al. 2014		
Sero group 8	LP	1.8	3.3	4.7	6.1			yes		Cervero-Aragó et al. 2014		
<i>Leptospira</i>												
<i>biflexa</i> serovar patoc Patoc I	LP	2.3	3.8	5.1	6.7			no		Stamm and Charon 1988		
<i>illini</i> 3055	LP	2.8	3.8	4.8				no		Stamm and Charon 1988		
<i>interrogans</i> serovar Pomona Pomona Pomona	LP	0.8	1.2	1.7				no		Stamm and Charon 1988		
<i>Listeria monocytogenes</i>	LP	2.2	3.0	3.2	4.1	4.6		no		Collins 1971		
<i>Mycobacterium avium</i>												
33B	LP	5.8	8.1	10	13			yes		Hayes et al. 2008		
W41	LP	5.7	7.9	10	12	15		yes		Hayes et al. 2008		

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione									
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference	
<i>Mycobacterium avium</i> (cont.)											
D55A01	LP	6.4	9.4	12	15			yes		Hayes et al. 2008	
<i>Mycobacterium avium hominissuis</i>											
HMC02 (white transparent) (WT)	LP	7.7	12	17	22			yes		Shin et al. 2008	
HMC02 (white transparent) (WT)	MP	8.1	12	16				yes		Shin et al. 2008	
HMC02 (white opaque) (WO)	LP	7.1	11	17				yes		Shin et al. 2008	
HMC02 (white opaque) (WO)	MP	6.6	11	15	19			yes		Shin et al. 2008	
<i>Mycobacterium bovis</i> BCG	LP	2.2	4.4					no		Collins 1971	
<i>Mycobacterium intracellulare</i>											
B12CC2	LP	7.8	11	13	16			yes		Hayes et al. 2008	
ATCC 13950	LP	7.4	11	15	19			yes		Hayes et al. 2008	
<i>Mycobacterium phlei</i>	LP	3.6						no		Collins 1971	
<i>Mycobacterium terrae</i>											
ATCC 15755	LP	3.9	9.3	16 + tailing				yes	(1)	Bohrerova & Linden 2006a	
ATCC 15755	LP	3.7	9.3	16				yes		Bohrerova & Linden 2006b	
ATCC 15755	MP	3.2	11	39				yes		Bohrerova & Linden 2006b	
<i>Mycobacterium tuberculosis</i>	LP	2.2	4.3					no		Collins 1971	
<i>Pseudomonas aeruginosa</i>											
ATCC 9027	LP	3.8	6.5	10	17			no		Abshire & Dunton 1981	
ATCC 10145	LP	4.6						no		Abshire & Dunton 1981	
ATCC 14207	LP	3.7						no		Abshire & Dunton 1981	
ATCC 15442	LP	3.8						no		Abshire & Dunton 1981	
ATCC 27853	LP	4.9						no		Abshire & Dunton 1981	
ATCC 27853	LP	0.8	1.6	2.3	3.1			yes		Clauß 2006	
ATCC 27853	Excimer 222 nm	3.1	4.8	5.9	7.5	10		yes		Clauß 2006	
01	LP	1.3	2.7	4.3	6.3	10		yes		McKinney & Pruden 2012	
B2	LP	5.6						no		Abshire & Dunton 1981	
G2	LP	3.0						no		Abshire & Dunton 1981	
BS4	LP	3.5						no		Abshire & Dunton 1981	
WB1	LP	5.8						no		Abshire & Dunton 1981	
SH-2918	LP	3.5						no		Abshire & Dunton 1981	
NCTC 10662	LP	1.5	2.6	3.8	5.0	6.2		yes		Blatchley et al. 2016	
<i>Salmonella spp.</i>	LP	<2	2	3.5	7	14	29	??		Yau et al. 2003	

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione										
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference		
<i>Salmonella typhimurium</i>												
ATCC 6539	LP	2.6	4.5	5.8	7	8		yes		Chang et al. 1985		
ATCC 19430	LP	2.0	4.1	6.2	8.3			yes		Wilson et al. 1992		
(in act. sluge)	LP	3	12	22	50			yes		Maya et al. 2003		
LT2 SL3770	LP	4	5.7	7.8				yes	Action spectrum	Chen et al. 2009		
	LP	3.9	5.3	6.7	7.7	13		yes		Hu et al. 2012		
<i>Serratia marcescens</i>	LP	2.2						no		Sharp 1939		
<i>Shewanella algae</i>	LP	0.9	1.7	2.4	3.2			no		Qiu et al. 2004		
<i>Shewanella oneidensis</i>												
DLM7	LP	0.3	0.5	0.8	1.1			no		Qiu et al. 2004		
MR4	LP	0.7	1.4	2.1	2.8			no		Qiu et al. 2004		
MR1	LP	0.2	0.4	0.6	0.9			no		Qiu et al. 2004		
<i>Shewanella putrefaciens</i> 200	LP	0.5	0.8	1.1	1.4			no		Qiu et al. 2004		
<i>Shigella dysenteriae</i>												
ATCC 29027	LP	0.1	1.0	1.9	2.8	3.8	4.7	yes		Wilson et al. 1992		
	LP	0.5	1.1	1.9	2.5	3.1		yes		Hu et al. 2012		
<i>Shigella paradyssenteriae</i>	LP	1.7						no		Sharp 1939		
<i>Shigella sonnei</i>												
ATCC 9290	LP	3.2	4.9	6.5	8.2			yes		Chang et al. 1985		
<i>Staphylococcus albus</i>												
	LP	1.8						no		Sharp 1939		
	LP	1.1	3.2	4.0	4.8			no		Collins 1971		
<i>Staphylococcus aureus</i>												
	LP	2.1	3.2					no	Action spectrum	Gates 1929		
(hem)	LP	2.6						no		Sharp 1939		
ATCC 25923	LP	3.9	5.4	6.5	10			yes		Chang et al. 1985		
ATCC 25923	LP	4.4	5.8	6.4	7.3	9		yes		Clauß 2006		
ATCC 25923	Excimer 222 nm	9.3	12	14	18			yes		Clauß 2006		
ATCC BAA-1556 (Methicillin resistant)	LP	4.5	7.2	8.8	10			yes		McKinney & Pruden 2012		
<i>Streptococcus faecalis</i> ATCC 29212	LP	6.6	8.6	9.8	11.1			yes		Chang et al. 1985		
<i>Streptococcus hemolyticus</i>	LP	2.2						no		Sharp 1939		
<i>Vibrio anguillarum</i>	LP	0.5	1.2	1.5	2.0			yes		Liltved & Landfald 1996		
<i>Vibrio cholerae</i>												
Classical OGAWA 154	LP	0.8	1.4	2.3	3.9	6.8		no		Banerjee & Chatterjee 1977		

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione										
Bacterium	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference		
<i>Vibrio cholerae</i> (cont.)												
el tor MAK 154	LP	1.7	4.1	7.1				no		Banerjee & Chatterjee 1977		
NAG 1976	LP	2.5	8.9					no		Banerjee & Chatterjee 1977		
ATCC 25872	LP	0.7	1.4	2.1	2.8	3.6		yes		Wilson et al. 1992		
<i>Vibrio parahaemolyticus</i> 2977	LP	4.4						no		Banerjee & Chatterjee 1977		
<i>Yersinia enterocolitica</i>												
Sero-group O:3 strain 304/84	LP	1.2	2.2	3.0	3.6			yes		Butler et al. 1987		
ATCC 4780	LP	2.1	4.1	5.0	5.8			yes		Clauß et al. 2005		
ATCC 4780	Excimer 222 nm	3.1	6.1	7.6	8.8	10	12	yes		Clauß et al. 2005		
ATCC 27729	LP	1.6	2.7	4.0	5.1			yes		Wilson et al. 1992		
<i>Yersinia pestis</i>												
A1122	LP	1.4	2.6	3.7	4.9			yes		Rose & O'Connell 2009		
Harbin	LP	1.3	2.2	3.2	4.1			yes		Rose & O'Connell 2009		
<i>Yersinia ruckeri</i>	LP	1	2	3	4			yes		Liltved & Landfald 1996		

Tabella 3. Fluenza per la riduzione logaritmica multipla per vari tipi di protozoi

Protozoan	Lamp Type	Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione					Proto-col?	Notes	Reference
		1	2	3	4	5			
<i>Acanthamoeba castellanii</i>									
ATCC 30234 (life stage: trophozoites; plaque assay)	LP	40					yes		Chang et al. 1985
CCAP 15342 (life stage: trophozoites; method: MPN)	LP	32	52	72			yes		Cervero-Arago et al. 2014
CCAP 15342 (life stage: cysts; method: MPN)	LP	45	75	91	125		yes		Cervero-Arago et al. 2014
<i>Acanthamoeba culbertsoni</i> ATCC 30171 (mouse infectivity assay; <i>Mus musculus</i> species, strain CD-1)	LP	38	58	125	148		yes		Maya et al. 2003
<i>Acanthamoeba spp.</i>									
isolated strain (life stage: trophozoites; mouse infectivity assay; <i>Mus musculus</i> species, strain CD-1)	LP	39	75	132	160		yes		Maya et al. 2003
155 (life stage: trophozoites; method: MPN)	LP	28	31	66	71		yes		Cervero-Arago et al. 2014
155 (life stage: cysts; method: MPN)	LP	34	67	99			yes		Cervero-Arago et al. 2014
<i>Cryptosporidium hominis</i> [cell culture infectivity assay using HCT-8 cells (CCL-244) & MDBK cells]	LP & MP	3.0	5.8				yes		Johnson et al. 2005
<i>Cryptosporidium parvum</i>									
[mouse infectivity assay (neonatal CD-1 mice)]	MP	<3	<3	<3	19		yes		Bolton et al. 1998; Bukhari et al. 1999
[mouse infectivity assay (neonatal CD-1 mice)]	LP	<3	<3	3-6	>16		yes		Clancy et al. 2000
[mouse infectivity assay (neonatal CD-1 mice)]	MP	<3	<3	3-9	>11		yes		Clancy et al. 2000
[mouse infectivity assay (neonatal CD-1 mice)]	LP & MP	2.4	<5	5.2	9.5		yes		Craik et al. 2001

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione									
Protozoan	Lamp Type	1	2	3	4	5	Proto-col?	Notes	Reference		
<i>Cryptosporidium parvum</i> (cont.)											
[mouse infectivity assay & cell culture infectivity assay using MDCK cells (CCL-34)]	LP	1	2	>5			yes		Shin et al. 2001		
[mouse infectivity assay (neonatal CD-1 mice)]	MP	<10	<10	>10			yes		Belosevic et al. 2001		
[mouse infectivity assay (SCID mice)]	LP	0.5	1.0	1.4	2.2		no		Morita et al. 2002		
[cell culture infectivity assay using HCT-8 cells (CCL-244)]	LP	2	<3	<3			yes		Zimmer et al. 2003		
[cell culture infectivity assay using HCT-8 cells (CCL-244)]	MP	<1	<1	<1			yes		Zimmer et al. 2003		
[culture-immunofluorescence (CC-IFA) based infectivity assay]	MP	1	2	2.9	4		yes		Bukhari et al. 2004		
[mouse infectivity assay (neonatal CD-1 mice)]	LP	<2	<2	<2	<4	<10	yes		Clancy et al. 2004		
[mouse infectivity assay (neonatal CD-1 mice)]	MP	<5	<5	<5	~6		yes		Amoah et al. 2005		
[cell culture infectivity assay using HCT-8 cells (CCL-244)]	LP	1.8	5.6	25			yes		Ryu et al. 2008		
HNJ-1 [mouse infectivity assay (SCID mice)]	LP	<0.7	<1.4	2.2			yes		Oguma et al. 2001		
[cell culture infectivity assay using HCT-8 cells (CCL-244)]	Laser 254 nm	1.3	1.9	2.3	2.8		yes	Action spectrum	Beck et al. 2015		
<i>Cryptosporidium spp.</i>	LP & MP	0.8	1.5	3.0	6.0		yes	(2)	Qian et al. 2004		
<i>Giardia lamblia</i>											
(excystation assay)	LP?	40	180				no?		Karanis et al. 1992		
(gerbil infectivity assay)	LP	<10	~10	20			yes		Campbell & Wallace 2002		
(gerbil infectivity assay)	LP	<0.5	<0.5	<0.5	<1		yes		Linden et al. 2002		
(gerbil infectivity assay)	LP	<2	<2	<4			yes		Mofidi et al. 2002		
<i>Giardia muris</i>											
(mouse infectivity assay)	MP	1	4.5	28 + tailing			yes		Craik et al. 2000		
(mouse infectivity assay)	MP	<10	<10	<25	~60		yes		Belosevic et al. 2001		
(mouse infectivity assay)	LP	<2	<2	<4			yes		Mofidi et al. 2002		
(mouse infectivity assay)	LP	<2	<2	~2	~2.3		no		Hayes et al. 2003		
(mouse infectivity assay)	LP	<5	<5	5			yes		Amoah et al. 2005		

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione							
Protozoan	Lamp Type	1	2	3	4	5	Proto-col?	Notes	Reference
<i>Giardia spp.</i>	LP & MP	0.6	1.1	1.9	3.4		yes	(2)	Qian et al. 2004
<i>Naegleria fowleri</i>									
Cysts (method: MPN)	LP	32	63	104	121		yes		Sarkar and Gerba 2012
Trophozoites (method: MPN)	LP	8	13	18	24		yes		Sarkar and Gerba 2012
<i>Toxoplasma gondii</i>									
oocysts [immunofluorescence assay (IFA)]	LP	7.2	13	17	19		yes		Dumètre et al. 2008
[mouse infectivity assay (SCID mice)]	LP	3.4	6.8	10			yes		Ware et al. 2010
<i>Vermamoeba vermiformis</i>									
CCAP 15434 /7A (life stage: trophozoites; method: MPN)	LP	11	19	26	34		yes		Cervero-Arago et al. 2014
CCAP 15434/7A (life stage: cysts; method: MPN)	LP	17	38	54	78		yes		Cervero-Arago et al. 2014
195 (life stage: trophozoites; method: MPN)	LP	10	17	24	32		yes		Cervero-Arago et al. 2014
195 (life stage: cysts; method: MPN)	LP	32	60	76	110		yes		Cervero-Arago et al. 2014

Tabella 4. Fluenza per la riduzione logaritmica multipla per vari tipi di virus

			Fluenza (dose UV) (mJ/cm2) per una data riduzione logaritmica senza foto-riattivazione									
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference	
Adenovirus												
Type 1 method: MPN	PLC/ PRF/5 and HeLa cell line	LP	35	69	103	138			yes		Nwachuku et al. 2005	
Type 2	PLC/ PRF/5	LP	40	78	119	160	195	235	yes		Gerba et al. 2002	
Type 2	Human lung cell line	LP	35	55	75	100			yes		Ballester & Malley 2004	
Type 2	A549 cell line	LP	20	45	80	110			yes		Shin et al. 2005	
Type 2	A549 cell line	LP	~30	~60					yes		Linden et al. 2007	
Type 2	A549 cell line	MP	~10	~20	~30	~40	~50		yes		Linden et al. 2007	
Type 2	A549 cell line	MP <240 nm blocked	~15	~30	~45	~60			yes		Linden et al. 2007	
Type 2	A549 cell line	LP	8	31	50	80	117		yes		Eischeid et al. 2009	
Type 2 method: TCID50	A549 cell line	LP	35	78	126	168			yes		Linden et al. 2009	
Type 2 method: TCID50	A549 cell line	MP	14	29	44	80	120		yes	(3)	Linden et al. 2009	
Type 2 method: cell culture	HEK293 cells human embryonic kidney	LP	37	88	120				yes		Baxter et al. 2007	
Type 2 adenoid 6 (VR-846)	A-549 cell line (CCL-185)	LP	42	83	124	166			yes		Sirikanchana et al. 2008	
Type 2	A549 cell line	MP	4	7	14	22	40 + tailing		yes		Eischeid et al. 2009	
Type 2 method: TCID50	A549 cell line (CCL-185)	LP	36	82					yes		Shin et al. 2009	
Type 2 method: TCID50	A549 cell line (CCL-185)	MP	15	29	45	59	80		yes		Shin et al. 2009	
Type 2 ATCC VR-846; method: TCID50	A549 cell line (CCL-185)	LP	56	108	159	206			yes		Bounty et al. 2012	
Type 2 method: plaque assay	A549 cell line (CCL-185)	LP	39	71	98	125			yes		Rodriguez et al. 2013	

			Fluenza (dose UV) (mJ/cm2) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
Adenovirus (cont.)											
Type 2 method: plaque assay	A549 cell line (CCL-185)	MP	7	18	28	47			yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 6 kb fragment	A549 cell line (CCL-185)	LP	5	20-50	100				yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 6 kb fragment	A549 cell line (CCL-185)	MP	4	15-50	100				yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 1 kb fragment	A549 cell line (CCL-185)	LP	18	50	100				yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 1 kb fragment	A549 cell line (CCL-185)	MP	<i>5 + tailing</i>						yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 10 kb fragment	A549 cell line (CCL-185)	LP	15						yes		Rodriguez et al. 2013
Type 2 method: LR-qPCR 10 kb fragment	A549 cell line (CCL-185)	MP	39	94					yes		Rodriguez et al. 2013
Type 2 ATCC VR-846 method: MPN	A549 cell line (CCL-185)	LP	43	86	130	174			yes	Action spectrum	Beck et al. 2014
Type 2 ATCC VR-846; method: LR-PCR 1.1 kbp fragment	A549 cell line (CCL-185)	LP	45	68					yes		Beck et al. 2014
Type 2 ATCC VR-846; method: LR-PCR 1.1 kbp fragment	A549 cell line (CCL-185)	Laser 254 nm	32	80-90 + tailing					yes		Beck et al. 2014
Type 2 ATCC VR-846 method: MPN	A549 cell line (CCL-185)	LP	40	76	120				yes		Beck et al. 2014

			Fluenza (dose UV) (mJ/cm2) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
Adenovirus (cont.)											
Type 2 ATCC VR-846 method: MPN	A549 cell line (CCL-185)	MP	8	18	34				yes	(3)	Beck et al. 2014
Type 2 ATCC VR-846 method: MPN	A549 cell line (CCL-185)	MP	32	71	135				yes	(4)	Beck et al. 2014
Type 2; method: cell culture	A549 cell line (CCL-185)	Laser 254 nm	40	70	101				yes		Beck et al. 2014
Type 2; method: infectivity	A549 cell line	LP	33	118					no		Calgua et al. 2014
Type 2; method: qPCR	A549 cell line	LP	140						no		Calgua et al. 2014
Type 2; method: MPN	A549 cell line (CCL-185)	LP	47	86	129	172			yes		Ryu et al. 2015
Type 2; ATCC VR-846; method: ICC-qPCR	A549 cell line (CCL-185)	LP	40	81	121	161			yes		Ryu et al. 2015
Type 2; method: total culturable virus assay	A549 cell line (CCL-185)	LP	26	100	135	168	203	234	yes		Boczek et al. 2016
Type 4; ATCC VR-1572; method: ICC qPCR	PLC/ PRF/5 ATCC CRL-8024	LP	10	34	69	116			yes		Gerrity et al. 2008
Type 5; method: cell culture	HEK 293 cells human embryonic kidney	LP	45	76	120				yes		Baxter et al. 2007
Type 5	HEK293	LP	38	76	114	152			yes		Guo et al. 2010
Type 5	HEK293	MP	23	45	68	90			yes		Guo et al. 2010
Type 5	PLC/PRF/5	LP	31	62	93	123			yes		Guo et al. 2010
Type 5	PLC/PRF/5	MP	22	43	65	87			yes		Guo et al. 2010
Type 5	XP17BE	LP	13	26	39	52			yes		Guo et al. 2010
Type 5	XP17BE	MP	9	18	27	36			yes		Guo et al. 2010
Type 5	A549 cell line (CCL-185)	LP	51	101	151				yes		Rattanakul et al. 2014

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione										
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference	
Adenovirus (cont.)												
Type 5	A549 cell line (CCL-185)	LP	63	100	151				yes		Rattanakul et al. 2015	
Type 5 ATCC VR5	A549 cell line (CCL-185)	UV-LED 285 nm	50	82	126				yes		Oguma et al. 2015	
Type 6; method: MPN	PLC/ PRF/5 and HeLa cell line	LP	39	77	115	154			yes		Nwachuku et al. 2005	
Type 40; strain: Dugan	PLC/PRF5 cell line	LP	50	109	167				yes		Thurston-Enriquez et al. 2003	
Type 40; method: MPN	PLC/PRF5 cell line	MP	16	23	~30	~40			yes		Linden et al. 2007	
Type 40; method: MPN	PLC/PRF5 cell line	LP	63	88	109	>120			yes		Blatchley et al. 2008	
Type 40	HEK293	LP	35	70	105	139			yes		Guo et al. 2010	
Type 40	HEK293	MP	17	33	50	66			yes		Guo et al. 2010	
Type 40	PLC/PRF/5	LP	34	67	101	134			yes		Guo et al. 2010	
Type 40	PLC/PRF/5	MP	16	33	49	65			yes		Guo et al. 2010	
Type 41; ATCC VR-930; method: ICC-RT-PCR	HEK 293 cells ATCC CRL-1573	LP	56	111	167	222			yes		Ko et al. 2005	
Type 41; method: cell culture	HEK 293 cells human embryonic kidney & PLC/PRF/5 (hepatoma) cells	LP	62	120					yes		Baxter et al. 2007	
Type 41	HEK293	LP	45	91	136	182			yes		Guo et al. 2010	
Type 41	HEK293	MP	20	39	59	78			yes		Guo et al. 2010	
Type 41	PLC/PRF/5	LP	34	68	103	137			yes		Guo et al. 2010	
Type 41	PLC/PRF/5	MP	18	36	53	71			yes		Guo et al. 2010	
Type 41	XP17BE	LP	14	29	43	57			yes		Guo et al. 2010	
Type 41	XP17BE	MP	11	21	32	42			yes		Guo et al. 2010	
Atlantic halibut nodavirus (AHNV)	SSN-1 cell line	LP	35	70	104	140	176	211	yes		Liltved et al. 2006	
B40-8 (phage)												
	<i>B. fragilis</i> HSP-40	LP	12	18	23	28			yes		Sommer et al. 1998	
	<i>B. fragilis</i>	LP	11	17	23	29	35	41	yes		Sommer et al. 2001	

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
Calicivirus feline											
	CRFK cell line	LP	5	15	23	30	39		yes		Thurston-Enriquez et al. 2003
	MDCK cell line	LP	7	15	22	30	36		yes		de Roda Husman et al. 2004
	CRFK cell line	LP	7	16	25				yes		de Roda Husman et al. 2004
FCV ATCC VR-782	Crandell Reese feline kidney cell CRfk, ATCC CCL-94	LP	5	12	18	26			yes		Park et al. 2011
Coxsackievirus											
B3	BGM cell line	LP	8	16	25	33			yes		Gerba et al. 2002
B4	BGM cell line	LP	7	13	18	24	29		yes		Shin et al. 2005
B5	BGM cell line	LP	9.5	18	27	36			yes		Gerba et al. 2002
B5	BGM cell line	LP	7	14	21				yes		Battigelli et al. 1993
Echovirus											
I	BGM cell line	LP	8	17	25	33			yes		Gerba et al. 2002
II	BGM cell line	LP	7	14	21	28			yes		Gerba et al. 2002
12	foetal rhesus monkey kidney cell FRhK-4, ATCC CRL-1688	LP	8	13	18	28	40		yes		Park et al. 2011
GA phage	<i>E. coli</i> Hfr K12 ATCC 23631	LP	18	38	58	87	121		yes		Simonet & Gantzer 2006
Hepatitis											
A HM175	FRhK-4 cell	LP	5.4	15	25	35			yes		Wilson et al. 1992
A HM175	FRhK-4 cell	LP	4	8	12	16			yes		Battigelli et al. 1993
A	HAV/HFS/GBM	LP	6	10	15	21			no		Wiedenmann et al. 1993
Infectious pancreatic necrosis virus (IPNV)	BF-2 cell line	LP	82	165	246	325			yes		Liltved et al. 2006
Infectious salmon anaemia virus (ISAV)	SHK-1 cell line	LP	2.5	5.0	7.5				yes		Liltved et al. 2006

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference
JC polyomavirus											
Mad-4 method: cell culture	SVG-A cells	LP	60	124	171				no		Calgua et al. 2014
Mad-4 method: qPCR	SVG-A cells	LP	>180						no		Calgua et al. 2014
MS2 coliphage											
	N/A	UV-LED 255 nm	14	26	38				yes		Aoyagi et al. 2011
	<i>E. coli</i> Famp	LP	13	25	44	64			yes		Rodriguez et al. 2014
	<i>E. coli</i> Famp	MP	9	17	31	46	56		yes		Rodriguez et al. 2014
	<i>E. coli</i> Cr63	LP	17	34					yes		Rauth 1965
	<i>E. coli</i> C3000	LP	35						yes		Battigelli et al. 1993
	<i>E. coli</i> ATCC15597	LP?	19	40	61				no		Oppenheimer et al. 1993
	<i>Salmonella typhimurium</i> WG49	LP	16	35	57	83	114	152	no		Nieuwstad & Havelaar 1994
	<i>E. coli</i> ATCC15597	LP	13	29	45	62	80		yes		Meng & Gerba 1996
	<i>E. coli</i> C3000	LP	13	28					yes		Shin et al. 2001
	<i>E. coli</i> K-12 Hfr	LP	21	36					yes		Sommer et al. 1998
	<i>E. coli</i> K-12	LP	19	36	55				yes		Sommer et al. 2001
	<i>E. coli</i> C3000	LP	20	42	68	90			yes		Linden et al. 2002
	<i>E. coli</i> ATCC 15977	LP	20	50	85	120			yes		Thurston-Enriquez et al. 2003
	<i>E. coli</i> ATCC 15977	LP	20	42	70	98	133		no		Lazarova & Savoye 2004
	<i>E. coli</i> C3000	LP	20	42	69	92			yes		Batch et al. 2004
	<i>E. coli</i> ATCC 15977	LP	29	58	87	116			yes		Nwachuku et al. 2005
	<i>E. coli</i> ATCC 15977	LP	14	33	50	66			yes		Hu et al. 2012
	<i>E. coli</i> K12 A/ λ (F+)	LP	22	48					yes		Rattanakul et al. 2014

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference
MS2 coliphage (cont.)											
	<i>E. coli</i> Famp ATCC 700891	LP	14	30	45	60			yes		Sholtes et al. 2016
	<i>E. coli</i> Famp ATCC 700891	UV-LED 260 nm	13	36	40	53			yes		Sholtes et al. 2016
method: cell culture	<i>Salmonella typhimurium</i> WG49	LP	20	40	61	91	119	146	no		Calgua et al. 2014
method: qPCR	<i>Salmonella typhimurium</i> WG49	LP	<180						no		Calgua et al. 2014
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	17	38	59	81	103	123	yes		Wilson et al. 1992
ATCC15977-B1	<i>E. coli</i> HS(pFamp)R	LP	16	45	72	100	128	154	yes		Thompson et al. 2003
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	15	32	51	72	98		yes		Lazarova & Savoye 2004
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	25	42	66	97			yes		Butkus et al. 2004
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	20	40	62	92	141	173	yes		Ko et al. 2005
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	20	40	62	92	141	173	yes		Ko et al. 2005
ATCC15977-B1	<i>E. coli</i> ATCC 15977	LP	18	38	59	80			yes		Sun & Liu 2009
ATCC15977-B1	<i>E. coli</i> NCTC12486	LP	20	40	60				yes	Action spectrum	Mamane-Gravetz et al. 2005
ATCC15977-B1	<i>E. coli</i> Hfr K12 ATCC 23631	LP	20	40	68	95	125		yes		Simonet & Gantzer 2006
ATCC15977-B1	<i>E. coli</i> ATCC 15597	LP	18	40					yes		Templeton et al. 2006
ATCC15977-B1	<i>E. coli</i> ATCC 15597 C3000	LP	14	29	45				yes		Bohrerova et al. 2006
ATCC15977-B1	<i>E. coli</i> Famp	LP	16	>30					yes		Lee et al. 2008
ATCC15977-B1	<i>E. coli</i> ATCC 15597	LP	20	39	61	83			yes		Blatchley III et al. 2008
ATCC15977-B1	<i>E. coli</i> ATCC 15597	LP	18	41					yes		Bowker et al. 2011
ATCC15977-B1	<i>E. coli</i> ATCC 15597	UV-LED 255 nm	25	50					yes		Bowker et al. 2011

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
MS2 coliphage (cont.)											
ATCC15977-B1	<i>E. coli</i> ATCC 15597	UV-LED 275 nm	25	55					yes		Bowker et al. 2011
ATCC15977-B1	<i>E. coli</i> Famp ATCC 700891	LP	14	32	51				yes		Park et al. 2011
ATCC15977-B1	N/A	LP	13	30	53	70			yes		Timchak & Gitis 2012
ATCC15977-B1	<i>E. coli</i> ATCC 15597 Migula	LP	18	52	75	92	106	116	yes		Guo & Hu 2012
ATCC15977-B1	<i>E. coli</i> ATCC 15597	LP	20	40	70	95	120	138	no		Sherchan et al. 2014
ATCC15977-B1	<i>E. coli</i> ATCC 15597 C3000	LP	20	45					yes		Jenny et al. 2014
ATCC15977-B1	<i>E. coli</i> ATCC 15597 C3000	UV-LED 260 nm	15	32	48				yes		Jenny et al. 2014
ATCC15977-B1	<i>E. coli</i> ER2738	UV-LED 255 nm	19	42	72				no		Simons et al. 2014
ATCC15977-B1	<i>E. coli</i> Hfr K12 ATCC23631	LP	6	13	21	29	37	46	yes		Song et al. 2015
ATCC15977-B1	<i>E. coli</i> HS(pFamp)R ATCC 700891	LP	18	33	63				yes	Action spectrum	Beck et al. 2015
ATCC15977-B1 (Action spectrum weighted fluence)	<i>E. coli</i> HS(pFamp)R ATCC 700891	MP	15	32	52				yes	Action spectrum	Beck et al. 2015
ATCC15977-B1	<i>E. coli</i> HS(pFamp)R ATCC 700891	LP	20	40	60				yes	Action spectrum	Beck et al. 2016
ATCC15977-B1	<i>E. coli</i> K12 A/ λ (F+)	UV-LED 285 nm	32	70	106				yes		Oguma et al. 2015
ATCC15977-B1	<i>E. coli</i> Famp ATCC 700891	LP	17	35	60	88	116		yes		Boczek et al. 2016

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
MS2 coliphage (cont.)											
F-specific	<i>E. coli</i> WG21	LP	8	17	25	33			yes		Havelaar et al. 1990
F-specific	<i>E. coli</i> WG21	MP	9	19	28	38			yes		Havelaar et al. 1990
ATCC15977-B1	<i>E. coli</i> C3000	LP	14	29	49				yes		Shin et al. 2005
ATCC15977-B1	<i>E. coli</i> ATCC 15597 C3000	LP	19	42	69				yes		Shin et al. 2009
ATCC15977-B1	<i>E. coli</i> ATCC 15597 C3000	MP	16	33	53	90			yes		Shin et al. 2009
DSM5694	<i>E. coli</i> NCIB 9481	LP?	4	16	38	68	110		no		Wiedenmann et al. 1993
Myoviridae	<i>E. coli</i> C	LP	1.8	3.6	5.1	6.7	8.5		yes		Shin et al. 2005
Murine norovirus											
NCIMB10108	RAW 264.7 cells	LP	10	15	22	27	30		yes		Lee et al. 2008
CW3	RAW 264.7 macropags ATCC TIB-71	LP	10	15	22	27	30		yes		Park et al. 2011
Phage B124-54	<i>B. fragilis</i> strain GB-124	LP	14	21	28				yes		Diston et al. 2012
PHI X 174											
(phage)	<i>E. coli</i> C3000	LP?	2.1	4.2	6.4	8.5	11	13	yes		Battigelli et al. 1993
(phage)	<i>E. coli</i> ATCC 15597	LP?	4	8	12				no		Oppenheimer et al. 1993
(phage)	<i>E. coli</i> WG5	LP	2.2	5.3	7.3	10.5			yes		Sommer et al. 1998
(phage)	<i>E. coli</i> ATCC 13706	LP	2.0	3.5	5	7			yes		Giese & Darby 2000
(phage)	<i>E. coli</i> WG5	LP	3	5	7.5	10	13	15	yes		Sommer et al. 2001
	N/A	UV-LED 255 nm	1.6	3.3	5.1				yes		Aoyagi et al. 2011
	N/A	UV-LED 280 nm	2.3	5.1	8.6				yes		Aoyagi et al. 2011
ATCC 13706	N/A	LP	7.1	14	21	28	37	47	yes		Timchak & Gitis 2012
	<i>E. coli</i> CN13	LP	N/A	N/A	N/A	8.9			yes		Rodriguez et al. 2014
	<i>E. coli</i> CN13	MP	N/A	N/A	N/A	6.7			yes		Rodriguez et al. 2014

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
Picornaviridae aphthovirus (foot and mouth disease virus)											
O189	baby hamster kidney (BHK-21) cell line	LP	25	50	75	100			no	(5)	Nuanualsuwan et al. 2008
A132	baby hamster kidney (BHK-21) cell line	LP	20	39	59	78			no	(5)	Nuanualsuwan et al. 2008
A Sakol	baby hamster kidney (BHK-21) cell line	LP	22	44	67	89			no	(5)	Nuanualsuwan et al. 2008
AS 1	baby hamster kidney (BHK-21) cell line	LP	31	63	94	125			no	(5)	Nuanualsuwan et al. 2008
Poliovirus											
Type 1 LSc2ab	MA104 cells	LP	N/A	5.6	11	17	22		yes		Chang et al. 1985
Type 1 ATCC Mahoney	N/A	LP	6	14	23	30			yes		Harris et al. 1987
Type 1 LSc2ab	BGM cell line	LP	2.8	11	20	28	37	46	yes		Wilson et al. 1992
Type 1	BGM cell line	LP	8.0	16	23	31			yes		Gerba et al. 2002
Type 1 LSc2ab	BGM cell line	LP	7	17	28	37			yes		Thompson et al. 2003
Vaccine strain method: plaque assay	N/A	LP	6.4	14	22	33			no		Lazarova & Savoye 2004
Vaccine strain method: TCID50	N/A	LP	6.4	14	21	31			no		Lazarova & Savoye 2004
Type 1	BGM cell line	LP	8.7	17	25				yes		Shin et al. 2005
Type 1	BGM cell line	LP	7	14	21	29	39	50 + tailing	yes		Simonet & Gantzer 2006
PRD-1 (Tectiviridae)											
phage	Salmonella typhimurium Lt2	LP	10	17	24	30			yes		Meng & Gerba 1996
ATCC BAA-769-B1	Salmonella typhimurium Lt2	LP	18	50	81	108	138		yes		Shin et al. 2005

			Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
PRD-1 (Tectiviridae) (cont.)											
	<i>Salmonella typhimurium</i> Lt2	LP	N/A	N/A	N/A	36			yes		Rodriguez et al. 2014
	<i>Salmonella typhimurium</i> Lt2	MP	N/A	N/A	N/A	32			yes		Rodriguez et al. 2014
Q_β											
	N/A	UV-LED 255 nm	11	23					yes		Aoyagi et al. 2011
	N/A	UV-LED 280 nm	27						yes		Aoyagi et al. 2011
	<i>E. coli</i> ATCC 15597 C3000	LP	12	25	40				yes		Jenny et al. 2014
	<i>E. coli</i> ATCC 15597 C3000	UV-LED 260 nm	9	19	29	41			yes		Jenny et al. 2014
ATCC 23631-B1	<i>E. coli</i> ATCC 23631	LP	8	18	28	40			yes		Blatchley III et al. 2008
ATCC 23631-B1	<i>E. coli</i> ATCC 23631	LP	N/A	20					yes	Action spectrum	Beck et al. 2015
ATCC 23631-B1	<i>E. coli</i> ATCC 23631	laser 254 nm	11	22	34	46			yes	Action spectrum	Beck et al. 2015
phage	<i>E. coli</i> Hfr K12 ATCC 23631	LP	12	23	36	50	66	83	yes		Simonet & Gantzer 2006
phage	<i>E. coli</i> K12 A/λ(F+)	LP	10	23	35				yes		Rattanakul et al. 2014
ATCC 23631-B1	<i>E. coli</i> K12 A/λ(F+)	UV-LED 285 nm	27	54	81				yes		Oguma et al. 2015
phage	<i>E. coli</i> K12 A/λ(F+)	LP	11	26	40	55			yes		Oguma et al. 2013
Reovirus											
3	Mouse L-60	LP?	11	22					yes		Rauth 1965
Type 1 Lang strain	N/A	LP	16	36					yes		Harris et al. 1987

			Fluenza (dose UV) (mJ/cm2) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Protocol?	Notes	Reference
Rotavirus											
SA-11	Monkey kidney Cell line MA 104	LP	8	15	27	38			yes		Sommer et al. 1989
	MA 104 cell line	LP	20	80	140	200			no		Caballero et al. 2004
SA-11	MA 104 cell line	LP	7	15	25				yes		Chang et al. 1985
SA-11	MA 104 cell line	LP	9	19	26	36	48		yes		Wilson et al. 1992
SA-11	MA 104 cell line	LP	7	15	23				yes		Battigelli et al. 1993
SA-11 ATCC VR-1565 method: cell culture; assay based on CPE	MA 104 cells ATCC CRL-2378.1	LP	7	15	31 + tailing				yes		Li et al. 2009
SA-11 ATCC VR-1565 method: RT-qPCR assay	MA 104 cells ATCC CRL-2378.1	LP	29	58	88	117 + tailing			yes		Li et al. 2009
Human (HRV-Wa)	N/A	LP	16	24	32	40			yes		Hu et al. 2012
SA-11	MA-104 cell line	LP	10	21	32	43	53		yes		Wilson et al. 1992
Siphoviridae	<i>E. coli</i> C	LP	1.8	3.6	5.7	7.5	9.3		yes		Shin et al. 2005
T1											
	<i>E. coli</i> CN13	LP	N/A	N/A	N/A	13			yes		Rodriguez et al. 2014
	<i>E. coli</i> CN13	MP	N/A	N/A	N/A	19			yes		Rodriguez et al. 2014
T1UV											
HER 468	<i>E. coli</i> CN13 ATCC 700609	LP	N/A	8.3					yes	Action spectrum	Beck et al. 2015
HER 468	<i>E. coli</i> CN13 ATCC 700609	Laser 254 nm	4.3	8.5	13	17			yes	Action spectrum	Beck et al. 2015
T4											
	<i>E. coli</i>	LP	1.1	2.0	3.0	4.0	6.7		yes		Bohrerova et al. 2008
	<i>E. coli</i>	MP	1.1	1.7	2.6	4.0	7		yes		Bohrerova et al. 2008
	<i>E. coli</i>	LP	3.6	8.0	13				yes		Hu et al. 2012
ATCC 11303	N/A	LP	3.7	7.4	11	17	23	29	yes		Timchak & Gitis 2012

			Fluenza (dose UV) (mJ/cm2) per una data riduzione logaritmica senza foto-riattivazione								
Virus	Host	Lamp Type	1	2	3	4	5	6	Proto-col?	Notes	Reference
T7											
	<i>E. coli</i>	LP	1.7	5.8	11	16	20		yes		Bohrerova et al. 2008
	<i>E. coli</i>	MP	1.3	3.7	8	13	18		yes		Bohrerova et al. 2008
coliphage	<i>E. coli</i> ATCC 11303	LP	2.7	6.0	11				yes		Bowker et al. 2011
coliphage	<i>E. coli</i> ATCC 11303	LP	2.7	6.0	11				yes		Bowker et al. 2011
coliphage	<i>E. coli</i> ATCC 11303	UV-LED 255 nm	2.9	6.9	14				yes		Bowker et al. 2011
coliphage	<i>E. coli</i> ATCC 11303	UV-LED 275 nm	2.7	6.0	12	17			yes		Bowker et al. 2011
ATCC BAA-1025-B2	<i>E. coli</i> CN13 ATCC 700609	LP	N/A	3.8					yes	Action spectrum	Beck et al. 2015
ATCC BAA-1025-B2	<i>E. coli</i> CN13 ATCC 700609	Laser 254 m	1.6	3.6	6.6				yes	Action spectrum	Beck et al. 2015
T7m											
ATCC 11303-B38	<i>E. coli</i> B ATCC 11303	LP	N/A	3.4					yes	Action spectrum	Beck et al. 2015
ATCC 11303-B38	<i>E. coli</i> B ATCC 11303	Laser 254 m	1.7	3.8	6.3	11			yes	Action spectrum	Beck et al. 2015
V₁ (Podoviridae)	<i>E. coli</i> WG5	LP	3.1	5.9	8.8				yes		Shin et al. 2005

Tabella 5. Fluenza per la riduzione logaritmica multipla per vari tipi di alghe e altri microrganismi

		Fluenza (dose UV) (mJ/cm ²) per una data riduzione logaritmica senza foto-riattivazione							
Microorganism	Lamp Type	1	2	3	4	5	Protocol?	Notes	Reference
<i>Ascaris suum</i>									
(intact eggs) from worms	LP	100	328 + tailing				yes		Brownell & Nelson 2006
(decorticated eggs) from worms	LP	30					yes		Brownell & Nelson 2006
<i>Cryptococcus carnescens</i> yeast PYCC 5988	LP	18	32				yes		Pereira et al. 2013
<i>Candida sp.</i> New species similar to <i>C. pomycola</i> yeast PYCC 5991	LP	<10	25				yes		Pereira et al. 2013
<i>Metschnikowia viticola/Candida kofuensis</i> yeast									
PYCC 5993	LP	10	20				yes		Pereira et al. 2013
PYCC 5994	LP	8	17				yes		Pereira et al. 2013
<i>Metschnikowia viticola/Candida kofuensis</i> yeast PYCC 5992	LP	10	23				yes		Pereira et al. 2013
<i>Microcystis aeruginosa</i>									
PCC7806	LP	10	28	>60			no		Sakai et al. 2011
PCC7806	MP	15	130	>200			no		Sakai et al. 2011
<i>Rhodosporidium babjevae</i> yeast PYCC 5996	LP	40	90				yes		Pereira et al. 2013
<i>Rhodotorula minuta</i> (Saito) yeast PYCC 5990	LP	43	90				yes		Pereira et al. 2013
<i>Rhodotorula mucilaginosa</i> yeast									
PYCC 5989	LP	44	81				yes		Pereira et al. 2013
PYCC 5995	LP	57	113				yes		Pereira et al. 2013
<i>Saccharomyces cerevisiae</i> XS800	LP	42	70	100			no		Kim et al. 2004
<i>Tetraselmis suecica</i> algae K0297	LP	370	540	720			no		Olsen et al. 2015

Note delle Tabelle

1. Spuntata nelle acque di scarico
2. Questi dati sono mediane derivate da un'analisi bayesiana di molti studi.
3. Fluenza pesata sul DNA.
4. Fluenza ponderata dello spettro d'azione.
5. La profondità dell'acqua era di soli 2 mm, quindi il fattore acqua sarebbe stato molto vicino a 1,0. Anche se le correzioni del protocollo non sono state fatte, le differenze sarebbero state molto piccole.

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