

Cyberbullying, Harm, and Behavioral Theory: A Socio-Legal Analysis in Malaysia

Mazlifah Mansoor*

Faculty of Law, University Technology MARA, Malaysia

*Corresponding Author

DOI: <https://dx.doi.org/10.47772/IJRISS.2025.91100364>

Received: 13 November 2025; Accepted: 20 November 2025; Published: 11 December 2025

ABSTRACT

Cyberbullying refers to the intentional infliction of psychological or emotional harm through online communication. In Malaysia, legal responses have historically targeted improper use of digital platforms rather than the harmful conduct itself. The enactment of the Penal Code (Amendment) Act 2025 addresses this legislative gap by introducing specific offences dealing with online harassment and bullying that cause fear, alarm, or distress. This paper aims to evaluate whether the punitive sentencing approach introduced under the amended law is justified in addressing the nature and social impact of cyberbullying. It applies doctrinal legal analysis, supported by behavioral theories including symbolic interactionism, space transition theory, and social learning theory, to understand the motivation behind online aggression. A survey of 106 respondents further assesses public awareness of cyberbullying laws and perceptions of punishment. Preliminary findings reveal that cyberbullying often stems from misinterpretation and imitation of negative behavior. Notably, 20.8% of respondents were unaware that indirect participation online can constitute abetment, and many struggled to distinguish harmful behaviour from unlawful conduct. In addition, an interview with educators, parents, and working adults reinforced survey findings by highlighting that anonymity, emotional impulsiveness, and social influence contribute to cyberbullying and that legal enforcement alone is insufficient. Although Malaysia's legal reforms are timely and necessary, sentencing must be supplemented with broader measures. It is recommended that punitive enforcement be integrated with education, counselling, and restorative practices, to address the underlying behavioural and psychological factors shaping online misconduct.

Keywords: Cyberbullying, Penal Code, Sentencing Theories, Malaysia, Social Theories

INTRODUCTION

Cyberbullying is a modern crime that can happen without personally knowing the victim or the victim knowing the aggressor (Mansoor, M. 2024). The hostility in the online platform can also occur without planning or due to peer imitation. On the other hand, cyberbullying can happen persistently in multiple forms and over a period of time. Victims often describe feelings of humiliation, anxiety, and isolation, while those who engage in harmful behaviour commonly do so behind a sense of distance or detachment created by digital platforms. Reports of young Malaysians experiencing severe emotional distress, and in some cases taking their own lives after sustained online harassment, underline the urgency of developing an effective and coherent response (Azriq, A., & Rokanatnam, T. (2021).

Section 233 of the Communications and Multimedia Act 1998 penalises improper use of online platforms addressing harmful online behaviour. Although widely applied, the provision has been criticised for its broad wording (Yusof et al., 2023).. For example, the act of flaming offensive content or exclusion from belonging to a particular online group amounts to improper use, and it fails to address the emotional and psychological dimensions of cyberbullying. Offences under the Minor Offences Act 1955 and the Penal Code also failed to capture the specific forms of harm associated with digital harassment. There was a public outcry for deterrent punishment due to the accused being fined in a case resulting in the victim taking her own life due to consistent cyberbullying. As a consequence, the Penal Code (Amendment) Act enacted offences of harassment, bullying,

and doxxing with mens rea of causing emotional and psychological harm. This development marks an important acknowledgement that emotional injury, reputational damage, and psychological distress are real harms that deserve legal recognition. Anyone found guilty can be sentenced to between 1 year imprisonment to a maximum of 10 years when the person provoked a suicide attempt or suicide.

However, punitive action alone cannot explain why cyberbullying occurs or what drives individuals to engage in such conduct. Much of the behaviour observed online arises from quick emotional reactions, misreading of messages, pressures within peer networks or a gradual loss of self-restraint in digital spaces. Theoretical perspectives explain the behaviour of the aggressor. Symbolic Interactionism explains that online interaction can easily be misunderstood due to the absence of tone, facial cues or shared context. Space Transition Theory suggests that people may behave online in ways that they would avoid offline because anonymity weakens social norms and reduces the fear of judgment. Social Learning Theory further illustrates how online behaviour, positive or harmful, can spread when users imitate what they see, especially when such conduct attracts attention or approval.

These theoretical insights explain why cyberbullying cannot be addressed effectively through legal penalties alone. Sentencing theories such as retribution, deterrence, incapacitation, and rehabilitation each offer a lens for understanding the criminal justice response, but in practice, sentencing for cyberbullying varies based on the offender's age, background, and the gravity of the behaviour. Rehabilitation is often limited to unstructured measures such as community service or police supervision, while opportunities for restorative approaches are rare. The resulting framework does not fully engage with the developmental, emotional, or social factors that contribute to online aggression.

This paper, therefore, adopts a socio-legal approach that incorporates legal analysis, behavioural theory, empirical survey data from 106 respondents, and focus group discussions. The aim is to evaluate the effectiveness of the 2025 Penal Code amendments and to explore how Malaysians understand cyberbullying, its harm, and the appropriate means of addressing it. By viewing the issue through an integrated lens, the study seeks to identify whether legal reforms alone are sufficient or whether Malaysia requires a more holistic strategy that combines enforcement with education, digital ethics, and community-based interventions to reduce and prevent cyberbullying.

LITERATURE REVIEW

Cyberbullying with multifaceted forms of aggression has attracted scholarly discussion on the definition and forms of cyberbullying. Cyberbullying is often defined as intentional harm carried out through digital communication, often repeatedly and with the ability to reach victims beyond physical boundaries (Smith and Slonje, 2010). Similarly, Willard (2007) frames it as a form of online aggression that undermines a person's dignity. The nature of cyberbullying, which differs from physical bullying, is in the form of anonymity and distance, as researched by Hinduja and Patchin (2010). They assert that aggressors can encourage individuals to act in ways they would usually restrain during direct interaction. Kowalski et al. (2014) further identify several forms of cyberbullying, such as harassment, exclusion, impersonation and outing, noting that harmful online behaviour evolves as communication platforms and user practices change.

The lack of a legal framework addressing cyberbullying is consistently highlighted by scholars. Mansoor (2024) observes that the law lacked a clear definition of cyberbullying before the 2025 amendments, leaving enforcement agencies without a dedicated legal category to address online harassment. The reliance on general legislative provisions created uncertainty for law enforcement, as well as victims who were often unsure whether their experiences were legally recognised (Ahmad et al., 2020; Albar, 2021). When prosecuting offences under Section 233 of the Communications and Multimedia Act 1998, they frequently encountered problems in proving intention (Ismail, 2020). The term improper use by annoying is not easily proven. The law before the amendment also did not give sufficient weight to the emotional and psychological injury of the victims (Rahman, 2022).

Comparative studies also provide useful reference points. Low and Gill (2022) describe Singapore as offering clearer protection through its Protection from Harassment Act 2014, which provides both criminal sanctions

and civil remedies. Yusof et al. (2023) similarly argue that Malaysia must adopt a more consistent definition of cyberbullying to avoid overlapping interpretations and inconsistent enforcement outcomes.

Beyond legal commentary, researchers have examined cyberbullying through behavioural and social theory. Saleh and Nurhadiyanto (2024) find that online hostility often emerges from reduced empathy and distortions of personal identity in digital environments. Jaishankar, through the Space Transition Theory (2019), explains that people may behave differently online because anonymity and invisibility weaken social norms and reduce the fear of consequences. Social Learning Theory adds another layer of explanation. Qing (2024) observes that harmful behaviour may be repeated when it receives attention, approval, or imitation, creating patterns of behaviour that spread quickly across online communities. Symbolic Interactionism also features strongly in the literature by showing that the meaning of messages in digital communication is shaped by individual interpretation. Without tone, expression or shared physical context, remarks intended as humour or casual criticism may be perceived as hostility, allowing conflicts to escalate quickly.

METHODOLOGY

The methodology of this paper is a mixed approach from a socio-legal perspective. The first is a doctrinal analysis of the Malaysian legal framework on cyberbullying, particularly the shift from Section 233 of the Communications and Multimedia Act 1998 to the new offences introduced through the Penal Code Amendment Act 2025. This review draws on statutory interpretation and existing academic commentary to assess how far the revised provisions meet current needs and whether they address earlier gaps in enforcement.

The second examines behavioural and sentencing theories to understand the nature of cyberbullying as a social behaviour influenced by intention, peer influence, online interaction and the limits of punishment. Insights from theories such as Symbolic Interactionism, Space Transition Theory and Social Learning Theory inform the discussion on why individuals behave differently in digital environments and why punitive measures alone may be insufficient.

Third is a descriptive survey that gathers information from 106 individuals of different ages, occupations and educational backgrounds. The survey measures their awareness of cyberbullying, their understanding of the law and their views on punishment for cyberbullying. The responses provide contextual insight that supports and strengthens the doctrinal and theoretical analysis.

Fourth, semi-structured interviews were conducted with a small subset of participants from diverse demographic groups, including educators, parents, and working adults, to gain qualitative insights into behaviour motivations and awareness of legal provisions. These interviews were thematically analysed based on symbolic interactionism, space transition theory and social learning theory, enhancing the social legal interpretations of cyberbullying. Through this integration of legal, theoretical, and empirical perspectives, the study aims to produce a more complete understanding of how Malaysians perceive cyberbullying and how the 2025 legal reforms operate in practice.

RESULTS AND DISCUSSION

Demographic Profile of Respondents

A total of 106 individuals participated in the survey. The results are presented in several parts to show who the respondents are, how familiar they are with the law, and what kinds of responses they believe are most suitable for addressing cyberbullying. The narrative presentation below provides context for the patterns that appear in the data.

Age

The respondents represented a range of age groups, although young adults formed the largest portion of the sample. Table 1 shows that most participants were between 21 and 30 years old, which reflects the group that is generally most active on digital platforms and therefore more likely to encounter or observe cyberbullying.

Table 1 presents the age distribution of respondents. A significant majority were between 21 and 30 years old (63.2 percent), followed by those aged 31–40 (19.8 percent). Only a small proportion were under 21 or above 50.

Table 1. Age Group Distribution

Age Group	Frequency	Percentage
Under 21	4	3.8%
21–30	67	63.2%
31–40	21	19.8%
41–50	7	6.6%
Above 50	7	6.6%
Total	106	100%

Gender

Table 2 shows that 59.4 percent of respondents were female, while 38.7 percent were male. A small number (1.9 percent) chose not to disclose their gender. The distribution is reasonably balanced and allows the data to reflect a range of perspectives.

Table 2. Gender Distribution

Gender	Frequency	Percentage
Female	63	59.4%
Male	41	38.7%
Prefer not to say	2	1.9%
Total	106	100%

Occupation

Table 3 indicates that students were the largest group in the study, followed by law enforcement and government officers. This combination provides insight from both the general public and individuals with some exposure to enforcement processes.

Table 3. Occupation

Occupation	Frequency	Percentage
Student	69	65.1%
Educator/Lecturer	6	5.7%
Law enforcement/Government officer	27	25.5%
Private sector employee	3	2.8%
Other	1	0.9%
Total	106	100%

Education Level

According to Table 4, nearly half of the respondents held a bachelor's degree, while others had completed diploma level, STPM or SPM qualifications. A smaller number had postgraduate degrees. Overall, the sample reflects a group with relatively high educational attainment, which may influence their awareness of legal issues.

Table 4. Education Level

Education Level	Frequency	Percentage
SPM (High School Cert)	16	15.1%
STPM/Diploma	29	27.4%
Bachelor's Degree	51	48.1%
Master's Degree or above	10	9.4%
Total	106	100%

Awareness of Cyberbullying Laws

General Familiarity with the Penal Code Amendments

Table 5 shows that while many respondents had heard of the Penal Code Amendment Act 2025, only a small number described themselves as very familiar with it. Most either understood the law only generally or were uncertain about the details. This suggests that public knowledge of the amendments remains limited.

Table 5. Familiarity with Penal Code Amendments

Level of Awareness	Frequency	Percentage
Very familiar	8	7.5%
Somewhat familiar	42	46.2%
Heard but unsure	49	39.6%
Not familiar at all	7	6.6%
Total	106	100%

Awareness of Specific Offences under Sections 507B to 507F

Public understanding of the new cyberbullying offences was uneven. Table 6 shows that Section 507B was the most recognised, while Section 507C was the least familiar. A significant number of respondents did not recognise any of the sections at all. This supports earlier commentary that legal reform alone does not guarantee public understanding.

Table 6. Awareness of Penal Code Sections 507B–507F

Section	Offence	Frequency	Percentage
507B	Threats, abuse or insults causing distress	54	50.9%
507C	Indirect participation in online bullying	22	20.8%
507D	Communications leading to harm or suicide	31	29.2%
507E	Doxxing	32	30.2%

507F	Circulating false or harmful content	37	34.9%
None aware		25	23.6%

Preferred Approaches to Preventing Cyberbullying

Prevention Priorities

Table 7 reveals that more than half of the respondents believed that Malaysia should use a combination of punishment, education and rehabilitation. Only a small number supported a purely punitive, educational or awareness-based approach on its own. This indicates that the public views cyberbullying as a complex problem that requires several types of intervention.

Table 7. Preferred Prevention Approach

Approach	Frequency	Percentage
Stronger penalties and enforcement	35	33%
Education and digital ethics	11	10.4%
Counselling/rehabilitation	2	1.9%
Public awareness campaigns	2	1.9%
Combined approach	56	52.8%
Total	106	100%

Is Punishment Alone Sufficient

As shown in Table 8, a large majority did not believe that punishment alone is enough to reduce cyberbullying. Only a small number agreed that punitive measures by themselves would be effective. The findings show strong support for complementary strategies, particularly those that address behaviour and understanding.

Table 8. Perception of Punishment Adequacy

Response	Frequency	Percentage
Yes	18	17%
No	85	80.2%
Unsure	3	2.8%
Total	106	100%

Rehabilitation and Behavioural Corrective Measures

Preferred Rehabilitation Options

Table 9 shows that restorative justice received the strongest support among respondents, followed by supervised community service, counselling and digital ethics education. These results suggest that the public prefers interventions that promote accountability, learning and behavioural change rather than punishment alone.

Table 9. Preferred Rehabilitation Measures

Rehabilitation Option	Frequency	Percentage
Counselling or therapy	53	50%
Digital ethics or empathy education	47	44.3%
Restorative justice	72	67.9%
Supervised community service	56	52.8%
Other comments	2	1.8%

Semi-structured interview

The protocol consisted of five thematic sections: (i) understanding and awareness of cyberbullying, (ii) behavioural motivations, (iii) cultural and social perspectives, (iv) views on types of punishment for cyberbullying, and (v) preventive strategies. Interviews were analysed using thematic analysis, with responses grouped under key behavioural theories, namely misinterpretation of online communication under symbolic interactionism, anonymity and online disinhibition under the space transition theory, and peer imitation and social influence under social learning theories. Themes were compared across demographic groups, namely educators, parents, and working adults, to identify patterns in perception and suggested interventions.

Results of the Interview

The participants were asked and encouraged to share personal observations, experiences and responses on the five thematic sections.

Understanding and Awareness

Interviews participants unanimously recognised cyberbullying as a serious form of harm despite the lack of physical interaction. Educators particularly emphasised its systemic occurrence among students, while parents expressed concern over its psychological impact and potential to trigger depression.

Behaviour and Motivation

Participants identified impulsive emotional reactions, misinterpretation of digital messages and peer influence as primary behavioural drivers. Anonymity and ease of digital access were also viewed as contributing factors that encourage aggressors to engage in harmful online conduct.

Cultural and Societal Perspectives

Some participants noted that Malaysian cultural values, particularly sensitivity to shame and public embarrassment, have intensified the impact of cyberbullying. The lack of open discussion within families and limited workplace intervention mechanisms were also seen as contributing factors to the psychological impact on the victims.

Law and Punishment

While participants acknowledged the importance of legal enforcement, most believed that punitive measures alone are insufficient. They stressed that deterrence is unlikely to be effective without concurrent efforts to educate and rehabilitate offenders.

Recommendations and Future Strategies

There was strong support for a combined intervention model integrating legal enforcement with digital ethics education, counselling and structure programmes and equipping families and institutions with clearer guidelines for early intervention.

DISCUSSION

Behavioural Motivation of Cyberbullying

The findings indicate that cyberbullying often arises from emotional impulsiveness and reactive behaviour within digital environments. The survey results highlight that the majority of respondents aged 21-30 are frequent digital users and therefore more likely to experience rapid communication and peer influence. This observation is consistent with studies by Kowalski et al. (2014) and Hinduja and Patchin (2010). Interview responses from educators further confirm that online aggression has become systemic among students, sometimes continuing over time.

Misinterpretation and Emotional Responses

Interview participants acknowledged that cyberbullying frequently escalates due to misunderstanding. Digital messages lack facial expression and tone. Making humor susceptible to being misread as provocation. This supports the principles of Symbolic Interactionism, aligns with Saleh and Nurhadiyanto (2024), who explained that reduced relational cues weaken empathy online. Survey findings also showed strong support for non-punitive approaches, suggesting respondents recognise that emotional responses online require education rather than punishment alone.

Anonymity and Online Disinhibition

The absence of real-time accountability enables users to behave more aggressively online than they would offline. Multiple interview responses highlighted anonymity as a primary enable of negative expression. Space Transition Theory supports this view, suggesting that individuals shift behaviour when transiting between physical and cyber environments. The survey finding that only 20.8% understood how indirect participation contributes to cyberbullying reflects this behavioural disconnect

Peer Reinforcement and Imitation

Survey and interview responses show that online behaviour is often influenced by observation and imitation. Some participants observed that aggressive comments are sometimes replicated as part of defending an initial victim. Qing (2024) notes that online visibility can encourage repeat behaviour. This supports Social Learning Theory, as users may emulate what is commonly displayed in digital spaces without assessing its legal or ethical consequences.

Legal Awareness and Sentencing Limitations

Although the 2025 Penal Code Amendment provides a clear structure for prosecuting cyberbullying, awareness of these provisions remains limited. Both survey and interview results suggest that most users recognise the term cyberbullying but cannot identify precise legal boundaries. This aligns with Ahmad et al. (2020), who noted that legal reforms often fail to reach the public. Sentencing theory explains that punitive measures assume rational decision-making, whereas interview respondents indicated that cyberbullying frequently stems from emotional reactions. The preference for rehabilitation and educational interventions reflects this behavioural context.

Recommendations for Integrated Strategies

The combined analysis suggests that cyberbullying should be addressed through a multidisciplinary framework, as shown in Table 10 below.

Table 10. Summary of Qualitative Themes, Findings, and Theory Alignment

Themes: Key Findings, Interview Insights, Supporting Theory, and Implications
<p>Behavioural Motivation</p> <p>Key Findings: Impulsive, reactive behaviour</p> <p>Interview Insight: Educators observed systemic aggression</p> <p>Supporting Theory -</p> <p>Implications: Need emotional regulation and training</p>
<p>Misinterpretation and emotional responses</p> <p>Key Findings: Messages misunderstood</p> <p>Interview Insight: Humour is mistaken for ridicule</p> <p>Supporting Theory: Symbolic Interactionism</p> <p>Implications: Improve digital empathy and understanding of different digital languages</p>
<p>Anonymity and disinhibition</p> <p>Key Findings: Aggression due to anonymity</p> <p>Interview Insight: Multiple accounts used</p> <p>Supporting Theory: Space Transition Theory</p> <p>Implications: Highlight cyber accountability</p>
<p>Peer Influence and Imitation</p> <p>Key Findings: Behaviour replicated via observation</p> <p>Interview Insight: Defence escalated into attacks</p> <p>Supporting Theory: Social learning theory</p> <p>Implications: Promote positive role modelling</p>
<p>Legal Awareness and Sentencing</p> <p>Key Findings: Low Awareness of the Law and Punishment</p> <p>Interview Insight: Heard of reform, unclear details</p> <p>Supporting Theory: Sentencing theory</p> <p>Implications: Combine punishment with education</p>
<p>Strategic response</p> <p>Key Findings: Preference for an integrated model</p> <p>Interview Insight: Support restorative practices</p> <p>Supporting Theory: Theory of restorative justice</p> <p>Implications: Holistic reform required</p>

CONCLUSION

The introduction of Sections 507B to 507F of the Penal Code is more than a legislative reform. It marks the final formal recognition in Malaysia of emotional and psychological harm due to online aggression. This paper demonstrates, however, that legal reform cannot transform digital behaviour. Awareness remains low, and cyberbullying often arises not necessarily from calculated wrongdoings. There is impulsive behavior, misinterpretation, and social reinforcement within digital environments.

By integrating behavioural theory and empirical findings, this paper shifts the discourse from cyberbullying as a purely legal issue to one that reflects evolving patterns of human interaction in virtual spaces. The findings indicate that current punitive measures operate on the assumption of rational intent. On the other hand, actual online aggression is frequently emotionally driven and socially influenced. This suggests that future prevention strategies must prioritise behavioural guidance alongside legal deterrence.

The evidence shows clear public support for an integrated approach that combines enforcement with structured education, counselling, and restorative practices. This aligns with contemporary sentencing theory, which acknowledges that sustainable change occurs when legal mechanisms are reinforced by personal accountability and value development.

Ultimately, cyberbullying is not only a breach of law but a failure to adhere to digital ethics. Legal reform established the boundaries of unacceptable conduct, while education cultivates the conscience that sustains them. For Malaysia to respond effectively, policy must evolve from penalising harmful behaviour to proactively cultivating responsible online engagement.

REFERENCES

1. Ahmad, S. A., Noor, N. A. M., Munirah, A., Isa, Y., Yusuff, Y., Ibrahim, H., Ghazali, O., & Zulkifli, A. N. H. (2020). Cyberbullying: Analysis of laws in Malaysia. *International Journal of Advanced Science and Technology*, 29(8), 143–154.
2. Albar, A. (2021). Cyberbullying in Malaysia: An overview of the legal framework and its adequacy. *Journal of Cyber Law and Policy*, 10(1), 45–60.
3. Ismail, S. (2020). Legal challenges in addressing cyberbullying in Malaysia. *Malaysian Law Journal*, 8(2), 78–92.
4. Low, W. L., & Gill, D. K. (2022). Malaysia's approach towards cyberbullying: The existing framework. *Journal of Legal, Ethical and Regulatory Issues*, 25(S2), 1–14. <https://doi.org/10.35631/IJLGC.730011>
5. Rahman, N. (2022). Reforming cyberbullying laws in Malaysia: A critical analysis. *Asian Journal of Law and Policy*, 17(3), 200–215.
6. Yusof, N. S., Hashim, S. N., & Jamil, S. S. (2023). Cyberbullying: A systematic literature review on the definitional criteria. *Journal of Cyber Psychology and Behavior*. Advance online publication.
7. Azriq, A., & Rokanatnam, T. (2021). Cyberbullying via social media: Case studies in Malaysia. *OIC-CERT Journal on Cybersecurity*, 3(1), 31–45. <https://www.oic-cert.org/en/journal/pdf/3/1/313.pdf>
8. Mansoor, M. (2024). Enhancing legal responses to cyberbullying in Malaysia: Addressing gaps and proposing reforms (Extended abstract). *E-Book of Extended Abstracts*, 78.
9. Mears, D. P., & Stafford, M. C. (2025). Gauging the totality of criminal legal sanctions and punishment: Implications for research and policy on retribution and deterrence. *Punishment & Society*. Advance online publication. <https://doi.org/10.1177/14624745251344576>
10. Saleh, S. N. A., & Nurhadiyanto, L. (2024). Identifikasi tindakan cyberbullying dalam aktivitas online role-playing berbasis media sosial. *Jurnal Manajemen, Pendidikan, dan Ilmu Sosial*, 5(3). <https://doi.org/10.38035/jmpis.v5i3>
11. Qing, M. (2024). The mechanism and prevention strategies of adolescent cyberbullying: Based on the perspective of social learning theory. *Advances in Psychology*, 14(9), 343–350. <https://doi.org/10.12677/ap.2024.149655>
12. Jaishankar, K. (2019). Cyber criminology and space transition theory: Contribution and impact. In *International Centre for the Prevention of Crime (Ed.), 6th International Report on Crime Prevention and Community Safety: Preventing Cybercrime* (pp. 101–110). International Centre for the Prevention of Crime. <https://doi.org/10.2139/ssrn.5082409>
13. Kowalski, R. M., Giumetti, G. W., Schroeder, A. N., & Lattanner, M. R. (2014). Bullying in the digital age: A critical review and meta-analysis of cyberbullying research among youth. *Psychological Bulletin*, 140(4), 1073–1137. <https://doi.org/10.1037/a0035618>

14. Hinduja, S., & Patchin, J. W. (2010). Cyberbullying prevention and response: Expert perspectives. Routledge.
15. Tokunaga, R. S. (2010). Following you home from school: A critical review and synthesis of research on cyberbullying victimization. *Computers in Human Behavior*, 26(3), 277–287.
<https://doi.org/10.1016/j.chb.2009.11.014>