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# Russian Chemical Reviews

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### **Methods for the synthesis of 3(5)-phosphonylated pyrazoles** 667

N.S.Goulioukina, N.N.Makukhin, I.P.Beletskaya

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Currently existing methods for the synthesis of 3(5)-phosphonylated pyrazoles are comprehensively surveyed and analyzed. The significant progress in this area in the last 10–15 years, associated with reactions of the Bestmann–Ohira reagent (as well as diazomethylphosphonates and phosphonylated hydrazonoyl halides) with a variety of dipolarophiles, is demonstrated. The 1,3-dipolar cycloaddition of diazo compounds to  $\alpha,\beta$ -unsaturated phosphonates and intramolecular heterocyclization of 1-diazoallylphosphonates and 3-diazoprop-1-enylphosphonates are discussed. The synthetic potential of the cyclocondensation of organophosphorus 1,3-dielectrophilic compounds with hydrazines is demonstrated. Methods for the introduction of a phosphonate group into the pyrazole ring are considered. Some useful examples of reactivity of 3(5)-phosphonylated pyrazoles are presented. Bibliography — 88 references.

### **Modern approaches to the synthesis and prospects for the use of cyanine dyes containing functional groups in the N-substituents** 684

M.V.Fomina, A.S.Nikiforov, S.P.Gromov

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Methods for the synthesis of mono-, tri-, penta- and heptamethine cyanine dyes containing functional groups in the N-substituents are considered. Approaches suitable for the preparation of both symmetrical and unsymmetrical dyes are presented. Examples of the practical use of cyanine dyes of this type as fluorescence labels and probes in biology and medicine, components of photoactive supramolecular structures, photosensitizers and photo- and electroluminescent materials are given. Bibliography — 106 references.

### **Synthesis of chlorins, bacteriochlorins and their tetraaza analogues** 700

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Currently known methods for the synthesis of hydrogenated derivatives of synthetic porphyrins, chlorins, bacteriochlorins, isobacteriochlorins and their tetraaza analogues, are considered. Reactions involving quasi-isolated double bonds including reduction, oxidative addition and cycloaddition are presented. Examples of direct synthesis of these macroheterocycles are given. Bibliography — 168 references.

S.I.Sadovnikov, A.I.Gusev, A.A.Rempel

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The theoretical and experimental results of recent studies dealing with nanostructured lead sulfide PbS are summarized and analyzed. The key methods for the synthesis of nanostructured lead sulfide are described. The crystal structure of PbS nanopowders and nanofilms is discussed. The influence of size of nanostructured elements on the optical and thermal properties of lead sulfide is considered. The dependence of the band gap of PbS on the nanoparticle (crystallite) size for powders and films is illustrated. Bibliography — 222 references.

**Synthesis and antitumour activity of 4-aminoquinazoline derivatives**G.N.Lipunova,<sup>a</sup> E.V.Nosova,<sup>a,b</sup> V.N.Charushin,<sup>a,b</sup> O.N.Chupakhin<sup>a,b</sup><sup>a</sup>*I.Ya.Postovsky Institute of Organic Synthesis, Ural Branch of the Russian Academy of Sciences, Ekaterinburg, Russia*<sup>b</sup>*Ural Federal University named after the First President of Russia B.N.Yeltsin, Ekaterinburg, Russia*

Data on the synthesis and antitumour activity of 4-aminoquinazolines are integrated and analyzed. The key methods for the synthesis of these compounds are considered, first of all, cyclocondensation of carboxylic acid derivatives and also oxidation of quinazolines and cyclization of disubstituted thioureas. Attention is paid to improvement of the preparation routes of the most well known pharmaceutical drugs based on this class of compounds — erlotinib, gefitinib and lapatinib. Approaches to the synthesis and the biological activity of new 4-aminoquinazoline derivatives including EGFR tyrosine kinase inhibitors, compounds of combined action and labelled compounds as agents for positron emission tomography are discussed. The review covers published data for the period from 1996 to 2014. Bibliography — 263 references.